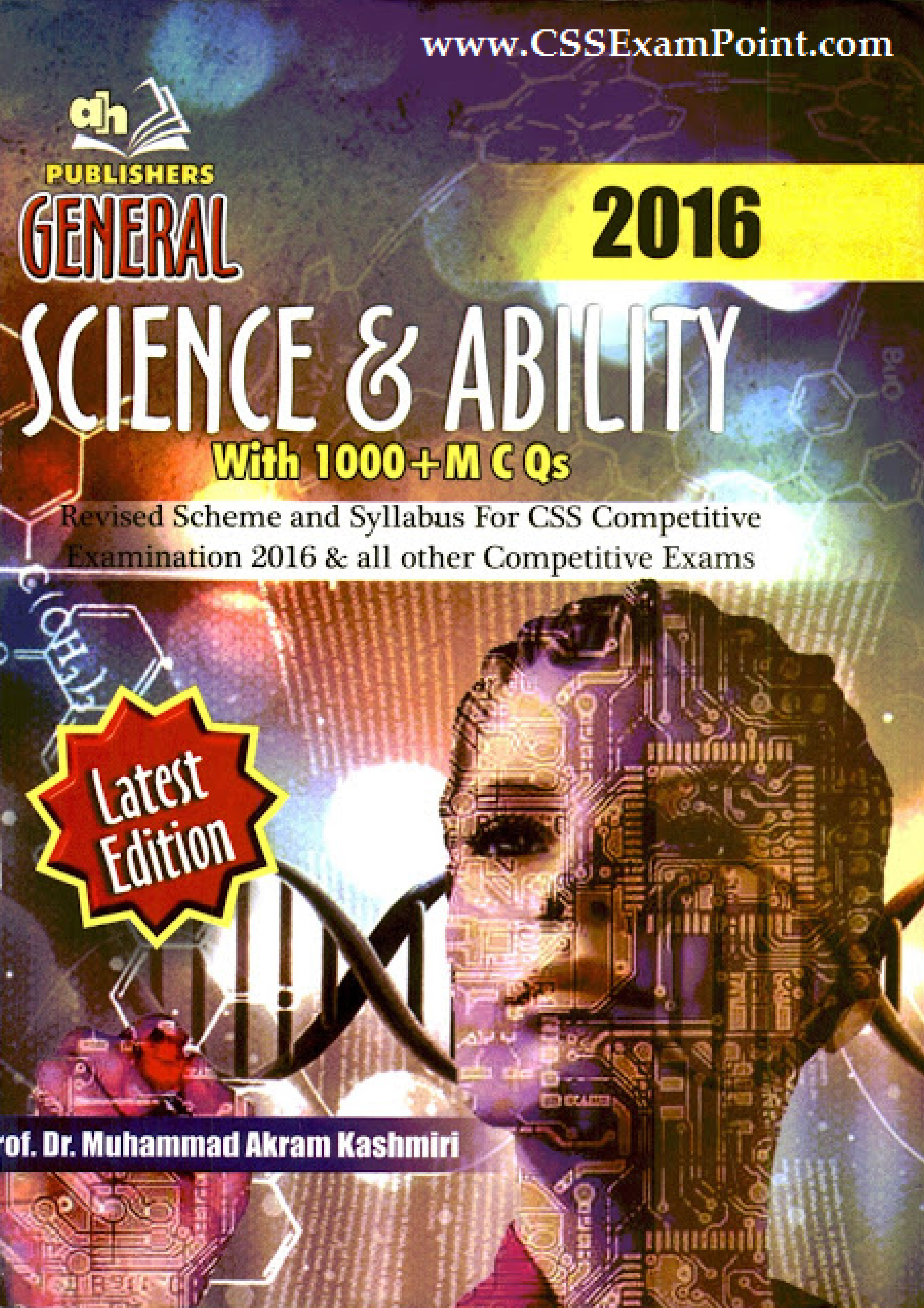

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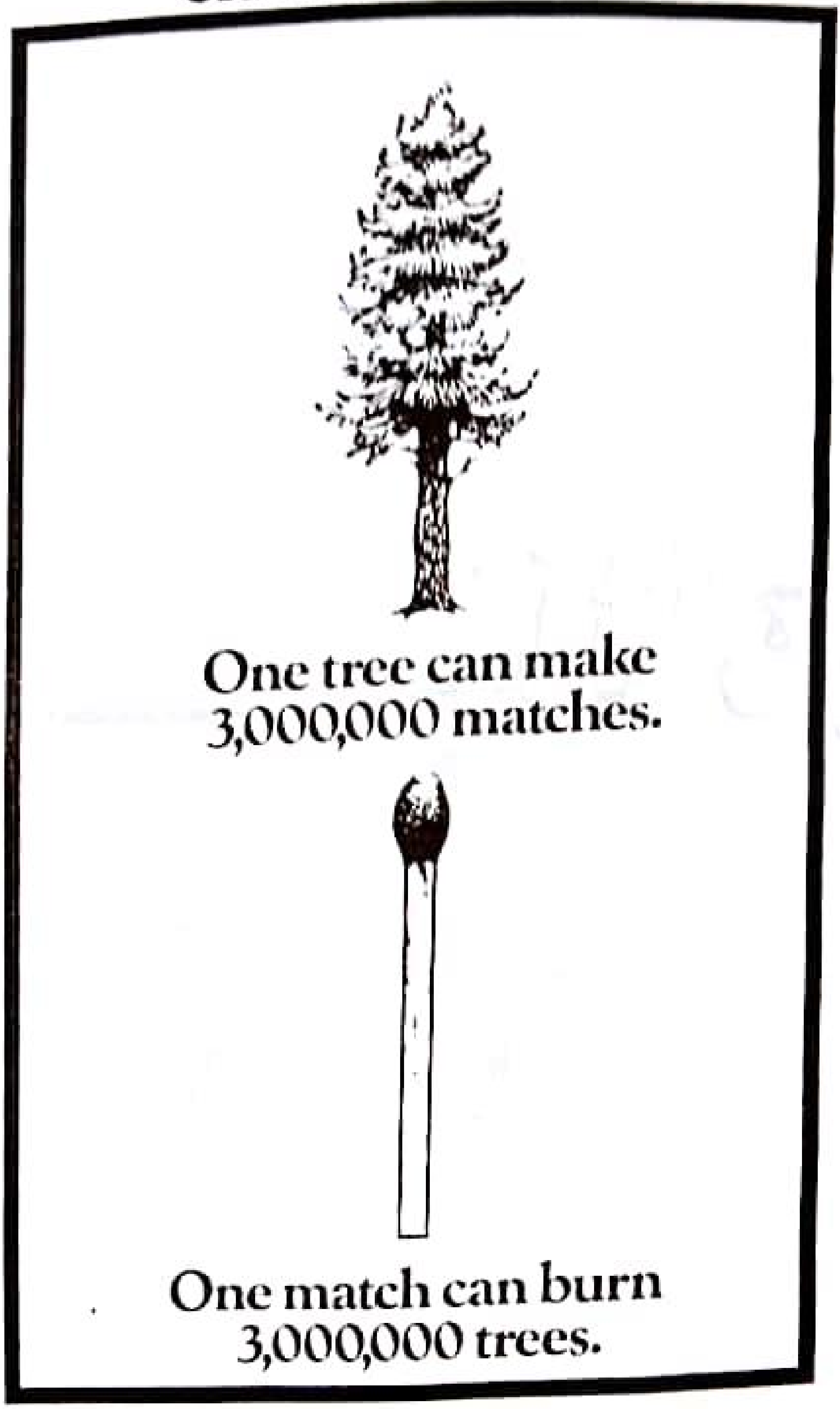
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According to the New Revised Scheme and Syllabus of
CSS Competitive Examination - 2016

GENERAL SCIENCE & ABILITY

Subjective/MCQs

For
CSS, PCS, PMS, M.Sc., GAT, NTS, ETEA

(Revised & Updated Edition)
2016

By
Prof. Dr. Muhammad Akram Kashmiri

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DEDICATION

"Dedicated to my youngest
beloved daughter
ZOBARIA AKRAM KASHMIRI
who has inspired me more than
anybody else in my recent past"

SYLLABUS

PAPER: GENERAL SCIENCE & ABILITY (100 MARKS)

Part-I (General Science) 60 Marks

(I) Physical Sciences

- **Constituents and Structure:** Universe, Galaxy, Light Year, System, Sun, Earth, Astronomical System of Units.
- **Process of Nature:** Solar and Lunar Eclipses, Rotation and Revolution, Weather Variables (Global Temperature, Pressure, Circulation, Precipitation, Humidity) and Weather Variations.
- **Natural Hazards and Disasters:** Earth Quake, Volcanic Eruption, Tsunami, Floods, Avalanche, Travelling Cyclone (Tropical Cyclone, Middle Latitude Cyclone and Tornadoes), Drought, Wildfire, Urban Fire. Disaster Risk Management.
- **Energy Resources:** Sources of Energy (Renewable i.e. LED Energy, Solar Energy, Wind Energy and Non-Renewable Energy conservation and its sustainable use.
- **Atomic Structure,** Chemical Bonding, Electromagnetic Radiations.
- **Modern Materials/Chemicals:** Ceramics, Plastics, Semi-conductors. Antibiotics, Vaccines, Fertilizers, Pesticides.

(II) Biological Sciences

- **The Basis of Life:** Cell Structures and Functions (Sub-cellular Organelles such as Nucleus, Mitochondria and Ribosomes).
- **Biomolecules:** Proteins, Lipids, Carbohydrates and Enzymes.
- **Plant and Animal Kingdom:** A brief survey of plant and animal kingdom to pinpoint similarities and diversities in nature.
- **A Brief Account of Human Physiology.**
- **Common Diseases and Epidemics:** Polio, Diarrhea, Malaria, Hepatitis, Dengue fever their Causes and Prevention.
- **New Model Concept of Producing BIO Fuel Method**

(III) Environmental Science

- **Environment:** The Atmosphere (Layered Structure and Composition). Hydrosphere (Water Cycle, Major Water Compartments), Biosphere (Major Biomes) and Lithosphere (Minerals and Rocks, Rock Types, Plate Tectonics).
- **Atmospheric Pollution:** Types, Sources, Causes and effects of major air pollutants (COx, Particulate Matter, NOx, SOx, Tropospheric Ozone, Volatile Organic Compounds, Dioxins). Regional and Global air pollution issues (Acid-rain, Ozone Depletion, Greenhouse Effect and Global Warming). International agreements on air pollution control (Montreal Protocol and Kyoto Protocol).
- **Water Pollution:** Types, sources, causes and effects of major water pollutants (Synthetic Organic Chemicals, Oxygen Demanding Wastes, Plant Nutrients,

Thermal Pollution, Infectious Agents, Sediments, Radioactivity, Heavy Metals and Acids) Drinking water quality and standards.

- **Land Pollution:** Solid waste management and disposal.
- Role of Remote Sensing and GIS in Environmental Science.
- Population Planning

(IV) Food Science

- **Concept of Balance Diet:** Vitamins, Carbohydrates, Protein, Fats and oil, Minerals, Fiber.
- **Quality of Food:** Bioavailability of Nutrients, Appearance, Texture, Flavor, Quality of Packed and Frozen Food, Food Additives, Preservatives and Antioxidants
- Food Deterioration and its Control: Causes of Food Deterioration, Adulteration, Food Preservation.

(V) Information Technology

- **Computer (Hardware & Software Fundamentals):** I/O Processing and data storage, Networking & Internet Standards, Application and business Software, Social Media Websites, Information Systems, Fundamentals of artificial intelligence.
- **Telecommunications:** Basics of Wireless Communication (Mobile, Satellite, Surveillance and GPS and Fiber Optic etc.

Part-II (General Ability) 40 Marks

(VI) Quantitative Ability/Reasoning

- Basic Mathematical Skills.
- Concepts and ability to reasons quantitatively and solve problems in a quantitative setting.
- Basic Arithmetic, Algebra and Geometry (Average, Ratios, Rates, Percentage, Angles, Triangles, Sets, Remainders, Equations, Symbols, Rounding of Numbers) Random Sampling

(VII) Logical Reasoning and Analytical Reasoning/Ability

- **Logical Reasoning** includes the process of using a rational, systematic series of steps based on sound mathematical procedures and given statements to arrive at a conclusion.
- **Analytical Reasoning/Ability** includes visualizing, articulating and solving both complex and uncomplicated problems and concepts and making decisions that are sensible based on available information, including demonstration of the ability to apply logical thinking to gathering and analyzing information.

(VIII) Mental Abilities

- Mental Abilities Scales that measures specific constructs such as verbal, mechanical, numerical and social ability.

****

PREFACE

The long awaited book on **General Science is & Ability** is finally in your hands. The highlights of this book are Connected Text, carefully tailored MCQs, relevant short answer questions and Concept Maps for quick revision. This book is equally good for beginners and those who have science background as the narration starts from the grass-root and builds up to the complexity of the topic to meet the requirements of the competitive examinations.

The genesis of the present revision of the curriculum for CSS examination by the FPSC hinges on Concept Based Learning rather than rote memorization by our young graduates coming from various universities. This is what has been taken care in writing this book. The contents of this book will not only prepare the candidates for written test but it will also equip them for the interview. The addition of more than one thousand relevant MCQs are thought provoking and it will go a long way to build the confidence of the candidates in everyday science discussions.

Material given in the appendices and solved questions papers in Everyday Science for the previous examinations will act as a supplement for the preparation of examination. Latest few question papers are purposely kept unsolved, to be worked out by the candidates as a homework.

Richly described contributions of a Muslim Scientists given at the end of the book should be taken as a Bonus for the students for preparing different kinds of examinations.

Although there is no end to the flood of scientific information coining all around in this world but if the contents of the book are read thoroughly and to the end it will act as a capsule for the candidates to handle all sorts of questions in the examination.

Prof Dr. Muhammad Akram Kashmiri
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Ph.D. (Chemistry) University of East Anglia (U.K.)
Post-Doctorate, University of Florida (U.S.A.)
Ex-Dean Faculty of Science,
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The End

CHAPTER
1

PHYSICAL SCIENCES

SCIENCE

INTRODUCTION

The word 'Science' is derived from the Latin (Roman) word 'Scientia' or 'Scire' which means knowledge. Science deals with the understanding of natural phenomena and the relations between them and its end is the rational interpretation of facts of existence as disclosed to us by our faculties and senses. The hypotheses of Science, according to a great thinker, Karl Pearson are formed on the basis of the observed facts, which, when confirmed by criticism and experiments are turned into the "Law of Nature". In the words of J. Arthur Thomson, "Science is the well-criticised body of empirical knowledge declaring in the simplest and tersest terms available at the time what can be observed and experimented with, and summing up uniformities of change in formula which are called laws verifiable by all who can use methods." Hypothesis, theory and law seems to be the vertices of the triangle of science based on experiments and observations.

BRIEF HISTORY OF SCIENCE

The history of science must include the history of the development of all aspects of knowledge. If science is considered as a branch of tested knowledge obtained by the accumulation of fact derived from observations and experiments then Myth and Religion mainly dominated as modes for explaining the world among early civilizations. Early Greek philosophers were the first to bring a change in this concept. They excluded supernatural causes from their accounts of reality. By the 3rd century B.C., Greek science was highly sophisticated and produced theoretical models that have shaped the development of science ever since. Although modern science is said to be the child of Greek science and the Renaissance is believed to have been brought about mainly by the restoration of the Greek Classics but still their work was not based on observation and experiment; a real scientific approach. Therefore, Greek science itself was not truly scientific. The Greeks were over-theoretical, for their science was an off-shoot of philosophy.

With the fall of Greece to the Roman Empire, science fell from grace. Science was almost unknown in Western Europe in the 5th century A.D. after the fall of the Romans. Islamic culture alone preserved Greek knowledge and later transmitted it back to the West. Muslim scholars were the first to make science meaningful and practical in the real sense by introducing observation and experiment as characteristic steps of scientific achievements.

During the time A.D 200-1200, when Europe was passing through the so-called: **"Dark Ages"**, the whole World was ringing with the scientific achievements of Muslim scholars like Avicenna and Averroes.

ARROW OF SCIENCE IN A CHRONOLOGICAL ORDER
MYTH AND SUPERSTITIONS
ABYLONIAN SCIENCE
EGYPTIAN SCIENCE
GREEK SCIENCE
ALEXANDRIAN SCIENCE
ISLAMIC SCIENCE
WESTERN SCIENCE
MODERN SCIENCE

ACHIEVEMENTS OF SOME GIANTS OF SCIENCE IN THE CHRONOLOGICAL ORDER

Name of the Scientist	Life-Span	Scientific Contributions
Pythagoras	580-500 B.C.	He formulated basic laws of geometry.
Aristotle	384-322 B.C.	He divided the Universe into two distinct regions. He also did the first systematic work on comparative Biology.
Archimedes (Italian)	287-212 B.C.	He gave famous Archimedes Principle for Floating Bodies.
Hippocrates	190-120 B.C.	He gave importance to the position of stars and made comprehensive list on the relative shift in the position of stars.
Johannes Kepler (German)	A.D. 1571-1630	He was the first person to show that the planets move around the sun in elliptic orbits. He gave laws of planetary motion.
Galileo Galilei (Italian)	A.D. 1564-1642	He developed the Astronomical Telescope.
Isaac Newton (English)	A.D. 1642-1727	He gave Laws of motion and Laws of Gravitation. He was Professor of Mathematics.
Charles Darwin (English)	A.D. 1809-1892	He was naturalist. He revolutionised Biology. He gave the theories of Natural Selection in Evolution.
Albert Einstein (German)	A.D. 1879-1955	He was a physicist. He revised classical physics with his theory of General Relativity.
Francis Victor (Austria)	A.D. 1889-1964	Discovered cosmic rays
James Watson (England)		Discovered the double helical structure of DNA.

Stephen Hawking (England)	A.D. 1942-today	He worked on Blackholes and gave the concept of Quantum Gravity. He also worked on theoretical cosmology.

READY-RECKONER OF CONTRIBUTIONS OF MUSLIM SCIENTISTS

Sr. No.	Name of the Muslim Scientist	Life-Span	Scientific
1.	Abu-Ubaidah	A.D. 728-825	Natural History. He wrote 50 books to the study of a single animal, the horse.
2.	M. Bin Musa At-Khuwarzimi	A.D. 780-847	Mathematics, Astronomy, Geography. He discovered zero and used decimal Notation.
3.	Jabir Ibn Hayyan (Geber)	A.D. 721-815	Practical Chemist. (Sulphuric acid)
4.	Abu Ishaq Kindi	Died A.D. 873	Mathematics, Astrology, Physics, Optics.
5.	AL-Battani	A.D. 858-929	Astronomy and Mathematics
6.	Zakariya Al-Razi	A.D. 865-925	Chemistry, Medicine, Physician.
7.	Abu Ali Sina (Avicenna)	A.D. 980-1037	Physician, Medicine.
8.	AL-Biruni	A.D. 973-1048	Mathematics.
9.	Ibn Al-Baitar	Died A.D. 1248	Botany, Pharmacy.
10.	Ibn Rushid (Averroes)	A.D. 1126-1198	Physician, Astronomy, Philosophy
11.	Nasir-ud-Din Al-Toosi	A.D. 1201-1274	Mathematics, Optics, Astrology, Astronomy, Geography.
12.	Abu Qasim Al-Zahrawi	A.D. 936-1013	Surgeon, Physician.
13.	Al-Farabi	A.D. 874-950	Mathematics, Metaphysics, Musical theorist, Mystical thinker like Plato. He believed in the immortality of the soul.
14.	M. Ibn Ibrahim Al-Fzari	Died 733	Mathematics.
15.	Umar Al-Khayyam	Died A.D. 1131	Algebra: Solution of cubic equations and their classification. He devised a new calendar.
16.	Habash Al-Hasib	Died between A.D. 864-874	Trigonometry, Astronomical tables. He was the first to determine the time by an altitude.
17.	Abdur Rehman Al-Sufi Medicine:	A.D. 903-986	He compiled an illustrated catalogue of stars.
18.	Al-Ghazali	A.D. 1058-1111	Some wrote a treatise on the motion and nature of the stars.
19.	Al-Farghani	Died A.D. 861.	He wrote a comprehensive treatise on astronomy.
20.	Al-Zarqali	A.D. 1028-1087	He gave an account of the trigonometrical

[redacted]

			knowledge of his time.
21.	Qutb-ud-Din Al-Shirazi	Died A.D. 1266	He discovered the possibility of the rotation of the Earth.
22.	Al-Nasavi	A.D. 1010-1075	He introduced the decimal system.
23.	Abdul Latif	A.D. 1162-1231	Medicine, Anatomy
24.	Ibn Zuhr (Advenzoar)	A.D. 1091-1161	Medicine: He was a physician.

SUBJECT-WISE READY-RECKONER OF MUSLIM SCIENTISTS

Sr. No.	Subject	Name of Scientists who contributed
1.	Mathematics	Al Kindi, Al-Khwarizmi, Al-Fazari and Al-Nasavi.
2.	Geometry	Hajjaj Ibn Yusuf, Banu Musa, Abut Wafa, AL-Mahani, Abu Kamil Al Sijzi, Al Baghdabi, Abdul Faraj, Abd-ul-Malik, Al Shirazi, Muhammad Ibn Al-Hussain and Kamal-ud-Din Yunus.
3.	Aljebra	Al-Khwarizmi, Abu Kamil, Umar Khayyam, Abu Wafa and Umar Ibn Ibrahim.
4.	Trigonometry	Habash-al-Hasib, Ibn Yusuf, Nasir-ud-Din Al-Tusi, Al Zarqali and Hasan-al-Marakushi, Al-Battani.
5.	Astronomy	Habash al-Hasib, Abu Said al-Darir, Al-Farghani, Abdur Rahman al-Sufi, Ibn Yusuf, Ibn Al-Haitham, Umar Khayyam, Al Ghazali, Al-Zarqali, Banu Amajur, Al-Khwarizmi, Ibn-Rushd, Al-Bitruni, Qutb-ud-Din, Al-Shirazi, Al-Ibn Umar-al-Katibi, Al-Hasan Al-Marakushi.
6.	Natural History (Botany and Zoology)	Abu Ubaidah, Al-Asma, Al-Jahiz, Muhammad Al-Dimhyari, Al-Bakri, Abdul Latif, Al-Ghafiqi, Ibn Sina, Ibn Sun and Al-Idrisi.
7.	Chemistry	Jabir Ibn Hayyan, Al-Jahiz, Abu Mansur Muwaffaq, Abdul Qasim, Al-Razi and Hasan Al-Rammah.
8.	Physics	Al-Kindi, Banu Musa, Al-Jahiz, Al-Narizi, Al-Beruni, Ibn Sina, Al-Razi, Ibn Jami, Al-Kahin-al-Attar Abdur Rehman Ibn Nasi, Qaisar-Ibn Abi-al-Qasim.
9.	Optics	Al-Kindi, Ibn-al-Haitham, Nasir-ud-Din Al-Tusi, Al-Shirazi, Qutb-ud-Din, Kamal-ud-Din Farisi.
10.	Geography	Ibn Sarafyun, Al-Mas'udi, Al-Istakhti, Ibn-Haukal, abdul fida, AL-Beruni, Al-Farghani, Al-Kindi, Abdul Latif, Al-Idnsi, Hasan-al-Marakashi.
11.	Medicine	AL-Kindi, Zakariya Razi, Ali Ibn Abbas, Abul Qasim al-Zahrawi, Ibn-al-Haitham, Ibn al-Wafid, Ammar, Ali Ibn Isa, Ibn Sina, Ibn Zuhr, Abdul Latif, Ibn-al-Nafis and Ibn-al-Baitar; Abu Ali Sina, Abu Mansur Muwaffaq.
12.	Scientific Instruments	Ibrahim al-Fazarum Muzaffar al-Tusi, Al-Badi, AL-Asturlabi, Tabin Ibn Aflah, Qaisar Ibn abial-Qasim Ibrahim Ibn Said al-Sahli Muhammad Ibn Hilal.

CENTURY-WISE READY-RECKONER OF MUSLIM SCIENTISTS

Century	Muslim Scientists
8th	Abu-Ubaidah, Jabir Ibn Hayyan, Al-Khawarzimi, Al-Fazari, Abdur Rahman Al-Sufi.
9th	Al-Kindi, Al-Farghani, Zakariya al-Razi, Al-Battani, Al-Masudi, Al-Faraghni.
10th	Abu Ali Sina, AL-Biruni, Ibn Al-Haitham, Abul Qasim Al- Zahrawi, Al-Farabi.
11th	Al-Mawardi, Al-Zarqal, Al-Khazini Ibn Zuhr, Al-Ghazali.
12th	Ibn Al-Baitar, Ibn Rushd, Ibn-ul-Baytar, Abdul Latif, Umar-al-Khayyam Hasan-al-Marakushi, Nasir ud-Din al Toosi.

CLASSIFICATION OF SCIENCE

There are many branches of science. In general, they fall into five broad groups depending upon different science subjects and their interaction with different matters. The major groups are given as under:

1. PHYSICAL SCIENCES

The physical sciences deal with matter, energy, movement and the structure of the Universe including machinery and technology. These essentially deal with the study of inanimate natural objects like Earth's sciences which includes:

(i) Astronomy
(ii) Physics
(iii) Chemistry
(iv) Geology
(v) Physical Geography
(vi) Cosmology

2. BIOLOGICAL SCIENCES

Biological science deal with the study of living organisms from microscopic bacteria to kangaroos, gum trees and humans with their structure, function, development and their behaviour with the surroundings. Some typical examples are:

(i) Botany
(ii) Anatomy
(iii) Entomology
(iv) Physiology
(v) Embryology
(vi) Zoology

3. ENVIRONMENTAL SCIENCE

Environmental science may be defined as a branch of science that seeks to understand the structure and the behaviour of the environment to its inhabitants. It is actually a multidisciplinary science touching:

(i) Biology
(ii) Ecology
(iii) Chemistry
(iv) Geology
(v) Engineering
(vi) Physics

4. FOOD SCIENCE

It is that branch of science which deals with different approaches to foods, its components, functions and preservation.

5. INFORMATION TECHNOLOGY

It is newly emerging branch of science which deals with computers, softwares and wireless communication.

THE UNIVERSE

CONSTITUENTS AND STRUCTURE

EDWIN HUBBLE (1889 – 1953)

INTRODUCTION

The branch of physical science which deals with the nature of the Universe, its overall structure and origin, is called cosmology. Until the 17th century, the Universe was thought to be static, infinite and unchanging: this is called the Steady-State Theory. However, Edwin Hubble (1889-1953), an American astronomer showed in 1920s that the space between the galaxies is increasing and the Universe is therefore expanding like a balloon that is being inflated.

Edwin Powell Hubble was the American astronomer who discovered in the 1920s that the universe was expanding.

THE ORIGIN: THE BIG BANG:

According to the Big Bang Theory, the Universe came into existence about 15 to 20 billion years ago when a cataclysmic explosion took place. The Echo of this big-bang can still be heard in the form of microwave radio signal from space. This is also called as the **3K** microwave background radiation first detected by Arno Penzias and Robert Wilson for which they were awarded the Nobel Prize. Before the birth of our Universe, there was no time, no matter and no space. All the energy and matter of the future cosmos were concentrated in a single point of energy. All the forces were unified in this single point and were in perfect harmony. By someway this harmony was disturbed and this triggered a catastrophic explosion, filling our space with every particle of matter hurled away from every other particle. Thus, this is how our Universe exploded into life; and matter, space and time came into being.

EXPANDING UNIVERSE:

Edwin Hubble discovered in 1920s that galaxies are moving away from us. The farther away they are, the faster they are moving, indicating that the Universe is expanding. This was endorsed by the RED SHIFT experiments. The shift is caused by the wavelength of the spectral line being lengthened as the galaxy moves away, and hence the phenomenon became known as the Redshift because red light has a longer wavelength than blue light. So the farther away a galaxy is, the faster it is moving away from the Earth and consequently the greater its redshift and thereby proving that the entire universe is expanding. Redshift is based on Light Doppler Effect.

ECHO OF THE BIG BANG

The echo of the Big Bang can still be heard in the form of radio signal as the sound waves do not travel through space. This 3K Microwave Background Signal discovered by

Arno Penzias and Robert Wilson proves that nothing is lost in this Universe. This further confirms the Law of Conservation of Energy and the Law of Conservation of Mass.

Arnzo Penzias (left) and Robert Wilson were working for the Bell Telephone Company when they discovered the cosmic background radiation with a radio telescope

The Future of the Universe: Open or Closed:

There are two main theories of the Universe: Open Universe or Closed Universe. Some physicists believe that our Universe will expand forever. Others are convinced that expansion of our Universe will slow down and finally start contracting ultimately resulting in the Big Crash or Crunch. If there is sufficient matter in the Universe, gravity will eventually win and begin pulling the galaxies together again, causing the Universe to experience a reverse of the big bang the big crunch. After this a new Universe may come into being with totally different laws of nature; this is the cyclic theory.

GALAXY

Galaxy is a fundamental unit of the Universe. It consists of several hundred thousands of stars together with interstellar gas and dust. Thousands of millions of galaxies stretch out to the limits of the observable Universe. They fall into four categories in shape; spiral, spherical, elliptical and irregular. Our galaxy is spiral, contains 10^{11} stars with a diameter of 10 light years and it is called the **Milky Way**. According to Greek legend, the pearly band of the Milky Way stretching across the sky is milk split from the breast of the godess Juno. The nearest spiral galaxy to the Milky Way is **Andromeda Galaxy;** it is 2,200,000 light years away from us. This is our galactic neighbour alongwith Large Magellanic Cloud which is 170,000 light years away. The arms of the spiral galaxy are called the **galactic arms.** A collection of galaxies is called **cluster.**

THE HUBBLE CLASSIFICATION

The most popular scheme of classification was devised by Hubble during the 1920s and revised by Sandage in 1961. According to them, there are three major classes of Galaxy namely Elliptical, Spiral and Irregular.

THE MILKY WAY GALAXY

The Milky Way is a spiral galaxy and the Sun lies on one of the spiral arms. Close to the milky way, visible from the southern hemisphere, lie the Magellanic Clouds: two irregular patches of light, which are, in fact, companion galaxies to our own. The Milky Way is so named because it appears in the sky as a broad misty band of stars that stretches from horizon to horizon.

Some of the important characteristics of the Milky Way Galaxy are:

1. The Milky Way is spiral in nature.
2. Its diameter is 100,000 light years.
3. Its thickness is 1,000 light years.
4. It has five arms namely, Orion arm, Sagittarius arm, Sputum Centaurs Arm and Cygnus Arm.
5. It has 200 billion stars.
6. The arms of the galaxy are rotating about the centre.
7. It is also moving in the direction of a large gravitational anomaly known as the Great Attractor.
8. It is a member of the Ellipsoidal so called "Local Group" of about 20 galaxies.
9. The Sun revolves around the nucleus of the galaxy once in 225 million years. This duration is called the Cosmic Year.
10. It is generally believed that the pearly band of milky way stretching across the sky is milk split from the breast of the goddess Juno.

ASTRONOMICAL SYSTEM OF UNITS

Length is an important unit for the measurement of distances between the two objects.

Distances between the planets and the Sun in the Solar System are measured in Astronomical Units instead of km because the distances between them are very large.

Astronomical Unit: It is defined as the average distance between the Sun and the Earth which is 150 million km and hence equal to 1 A.U.

1 AU = 150 million km

A comparative chart of distances of the planets from the Sun in km and AU is given below:

ASTRONOMICAL UNIT VS KM

Planet		Average distance from the Sun	AU
1.	Mercury	58 million kms.	0.387
2.	Venus	108 million kms.	0.723
3.	Earth	150 million kms.	1.000
4.	Mars	228 million kms.	1.542

5.	Jupiter	778 million kms.	5.186
6.	Saturn	1,427 million kms.	9.539
7.	Uranus	2,870 million kms.	19.80
8.	Neptune	4,497 million kms.	30.06
9.	Pluto	5,900 million kms.	39.33

Light Year: It may be defined as the distance which the light will travel in one year. This is still a bigger unit used to measure distances between the stars and the galaxies. In whole numbers, it is equal to 9500 billion km. The exact value for the distance in one light year can be calculated as follows:

One Light Year = 186,000 × 1.609 × 60 × 60 × 24 × 365.25
= 9,461 Billion km.
Speed of Light = 1,86,000 miles/second.

Distances in light year/minutes for some Heavenly bodies are given below:

Distance	Light Speed (186,000 miles/second)
Sun	8.5 minutes
Mars	5 minutes
Pluto	5 hours, 25 minutes
Alpha Centauri (closest star)	4.2 years
Sirius (brightest star as seen from the earth)	8.4 years
Pleiades Star Cluster	400 years
Center of the Milky Way	38,000 years
Andromeda Galaxy	2.2 million years

Our Sun is at a distance of 27000 light years away from the centre of the Milky Way.

Par sec: It is still a bigger unit of distance used in galaxies. It is defined as the distance of star with parallax shift of one are second from a base of 1A° unit.

One Par sec = 3.26 Light years.

A comparative chart for measuring distances between the two objects in a micro or macro system is given below:

COMPARATIVE TABLE FOR MEASURING DISTANCES

Name of Unit	Symbol	Relation to SI Units
Angstrom	A°	= 1×10^{-10}m or = 0.1nm
Nanometer	nm	= 1×10^{-9}m
Micron	μ	= 1×10^{-6}m
Mile	mi	= 1.609 km or 1609.344 m
Astronomical unit	AU	Average distance between the Sun and the Earth = 149,597,870m = 149.597 million km. Usually rounded to 150 million km.
Light year	ly	It is the distance which the light travels in vacuum in 365.25 days.

		= 9.4607 × 10^{15}m = 9460.7 billion km Usually rounded to 9500 billion km
Par sec	pc	Distance of star with parallax shift of one arc second to a basic of one AU = 3.26 light year.

SOLAR SYSTEM

STRUCTURE:

A yellow dwarf star of the Milky Way Galaxy called the Sun is the centre of the Solar System in which nine planets are orbiting around it in elliptic orbits alongwith about 50 natural satellites called the Moons as a family. There are two parts of the structure of the Solar System namely:

(i) Inner Solar System (ii) Out Solar System

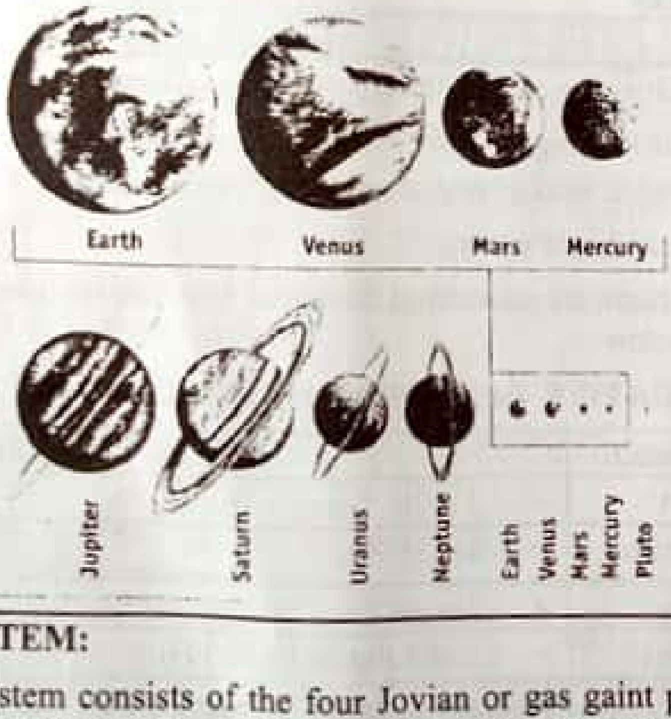
INNER SOLAR SYSTEM:

Inner Solar System consists of the four terrestrial planets:

Mercury, Venus, the Earth and Mars. They are relatively closer to the Sun and are rocky in nature.

PLANET SIZES

The inner planets are all quite similar in size, compared to the variation between the outer planets. Mercury is smallest, at 4,880 kilometres and is about one-eighteenth the mass of the Earth.

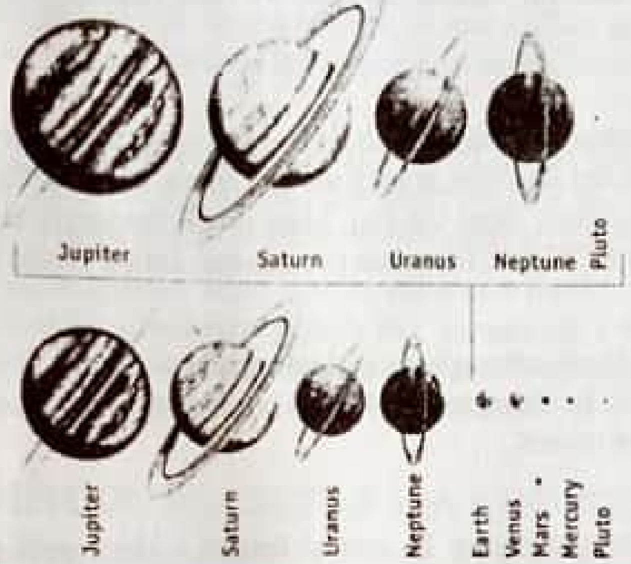


OUTER SOLAR SYSTEM:

Outer Solar System consists of the four Jovian or gas gaint planets: Jupiter, Saturn, Uranus and Neptune plus Pluto. These planets orbit at the farthest distances from the Sun. They are diverse, inhospitable worlds, some with poisonous atmospheres, some with no solid surfaces, some baked to enormous temperatures and some cooled to well before freezing. They all have small cores of iron and rock, but they are made mostly from gases. This means that they are all quite light for their size. The density of the Saturn is smaller than water and it will virtually float in a bathtub of water big enough to hold it. All have ring systems except Pluto.

PLANET SIZES

All the outer planets except Pluto have ring systems, although none is as spectacular as Saturn's. Also, all but Pluto have not just one moon Titan are both substantially bigger than the planet Mercury.



OTHER FASCINATING OBJECTS OF THE SOLAR SYSTEM

There are some other objects present in the Solar System which also orbiting around the Sun. They are:

(i) ASTEROIDS (ii) METEORITES (iii) COMETS

These are also called by some fancy names like INTRUDERS, LEFT OVERS OR SOLAR WANDERERS.

CONSTITUENTS OF THE SOLAR SYSTEM

Solar system is a tiny part of a galaxy and consists of the sun and all the objects that travel around it. It includes the Earth and eight other planets, along the satellites that travel around most of them. It further includes Asteroids, Meteoroids, Comets, Inter-planetary dust and Inter-planetary plasma. The planets are described in detail below:

Mercury:

It is the second smallest planet in this solar system and is closest to the Sun. Its mean distance from the Sun is 0.387 astronomical units (AU). Its equatorial diameter is 4,880 km. It takes 88 Earth days to complete one revolution around the Sun. Mercury looks a lot like the Moon, covered with holes called Craters. There are great soaring cliffs on the surface of Mercury, called scarps. It has no moon.

Venus:

It is called as Earth's Twin in size and mass. Venus is hotter than Mercury. The planet is wrapped in thick clouds of gas called carbon dioxide which traps the Sun's heat like the windows of a greenhouse. Venus is 0.723 AU away from the Sun. Its revolution period is 225 days. Its equatorial diameter is 12,104 km. It also has no moon.

Earth:

It is the most wonderful planet of the Universe. It is one A.U. away from the sun. Its equatorial diameter is 12,756 km. The Earth is the largest of the terrestrial planets. Seen from space, the Earth is a beautiful ball of colours — blue oceans, white clouds, and brown continents. It has a Moon.

Mars:

It is in direct contrast to Venus with its hot and opaque atmosphere. Mars is a barren desert. It is covered with red dust that is why we call Mars, the Red Planet. There is no water on Mars. It is 1.524 A.U. away from the sun. Mars orbits the sun once after every 687 days. Its equatorial diameter is 6,787 km. Mars has two moons, called Phobos and Deimos.

Jupiter:

It has a dense, cloudy atmosphere of hydrogen and helium. It is actually the largest planet of the solar system. Its diameter is 143,000 km. Jupiter orbits the Sun once after every 11.86 years. It has sixteen moons.

Saturn:

It is the second largest planet. Its special feature is the superb rings of Saturn which have the appearance of a larger extremely thin and flat circular sheet. It is 9.539 A.U. away from the Sun and its revolution period is 29.46 years. Its diameter is 120,000 km. It has at least 22 moons.

Uranus:

It has mostly hydrogen and helium atmosphere, is 19.18 A.U. away from the Sun. It's diameter is 51,800 km. Its revolution period is 84.01 years. It has fifteen moons. Uranus is big and gives greenish glow.

Neptune:

It is similar to Uranus. It is 30.06 A.U. away from the Sun. Its diameter is 49,500 km. Its revolution period is 164.8 years. Neptune has only two known moons.

Pluto:

It is the most distant and the smallest planet in the solar system. Its diameter is 400 km. Pluto orbits the Sun once every 248.4 years. It has a very low temperature. It has only one moon called Charon.

SOLAR SYSTEM REVISITED

9TH PLANET PLUTO ALERT

PLUTO – A PLANET OR A PLUTOID

Why is Pluto not called a Planet Anymore?

In 2003, an astronomer saw a new object beyond Pluto. The astronomer thought he had found a new planet. The object he saw was larger than Pluto. He named the object Eris (EER-is).

Finding Eris caused other astronomers to talk about what makes a planet a "planet." There is a group of astronomers that names objects in space. This group decided that Pluto was not really a planet because of its size and location in space. So Pluto and objects like it are now called dwarf planets.

Pluto is also called a Plutoid. A Plutoid is a dwarf planet that is farther out in space than the planet Neptune. The three known Plutoids are Pluto, Eris and Makemake (MAH-kee-MAH-kee). Astronomers use telescopes to discover new objects like Plutoids.

Scientists are learning more about the universe and Earth's place in it. What they learn may cause them to think about how objects like planets are grouped. Scientists group objects that are like each other to better understand them. Learning more about far away objects in the solar system is helping astronomers learn more about what it means to be a planet.

LATEST ON PLANETS NASA COMMENTS

CERES is the largest object in the Asteroid belt, while PLUTO is the largest object in the Kuiper belt.

Ceres and Pluto are both spheroidal objects, like Mercury, Earth, Jupiter and Saturn. That's part of the agreed upon definition of a planet. They both orbit a star/the Sun, like Venus, Mars, Uranus and Neptune. That's also part of the widely accepted definition of a planet.

NASA is working on both of them and it is hoped that both Ceres and Pluto may be declared planets next year making the total number of planets in the Solar System Ten instead of Nine.

SATELLITES

Definition: Bodies or objects that revolve around the planets.

Kinds: Natural or Planetary Satellites or Artificial Satellites.

NATURAL SATELLITES: These are heavenly bodies which revolve around the planets of the solar system in elliptical orbits analogues to the revolution of the earth around the sun. There are 64 natural satellites in the solar system.

Sr. No.	PLANET	Known Satellites	Famous Named, Latest discovered
1	Mercury	0	
2	Venus	0	

3	Earth	01	The MOON
4	Mars	02	Phobos, Demos
5	Jupiter	17	Metis, Adrastea, Thebe, Anake, Carme, Sinope, S/1999JI
6	Saturn	18	Pan, Atlas, Prometheus, Pandora, Epimethens, Telests
7	Uranus	17	Miranda, Cressida, Belinda, Caliban, Sycorax
8	Neptune	08	Triton, Thalassa, Despina, Larissa, Proteus
9	Pluto	01	Charon

ARTIFICIAL SATELLITES: These are man-made objects launched into the earth's orbit for communication and weather-forecasting purposes. These are also called as communication satellites.

Geostationary Orbits: In 1945, Arthun C. Clarke identified geostationary orbits, which have orbital periods of 24 hours. These allow telecommunication and weather satellites to stay over the same place on the earth. This technique was used for the first time to televise the 1964 Olympic Games.

Space Milestones: Sputnik 1 (1957) Early Bird (1965), WRESAT (1967) Iridium (1997)

Main Uses: Worldwide transmission of TV, telephone and computer data weather forecasting and resource exploration.

GPS: Biggest growth sector in Satellites: Global Positioning System

SPACED-OUT SPECTACLES

QUASARS

Quasars are abbreviated as, Quasi Stellar Sources. These are very luminous distance objects characterized by having extremely red shifted spectra. About 17200 quasars have been catalogued. The most remote object currently known as Quasar PC 1247 + 3406, which is at a distance of 13200 million light years away.

NEBULA

Nebula is derived from a Greek word which means cloud. Found throughout the universe, gas and dust fill the spaces between the stars. In some places they gather in great enough quantities to form a spectacular cloud, called a Nebula. There are two kinds of Nebulae, Luminous diffuse Nebulae and Dark observing nebulae over the Milky way. They are mod of dust and gases.

Horsehead Nebula is famous nebula. Dust in the horse's head is so thick that it blocks the light behind it.

Dust and gas also make for the brilliant red colour in the nebula. The blue colour comes from dust that reflects the light of nearby stars.

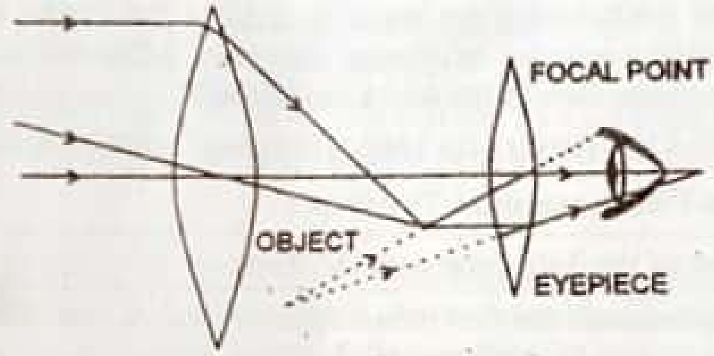
CLASSIFICATION OF STARS

Stellar classification of stars is based upon the colour of the star which gives an indication of its temperature. Henry Draper Stellar classification of the stars is given below:

Type of Star	Colour of the Star	Surface Temperature of the Star
O	Hottest Blue Star	25,000 to 40,000°C
B	Hot Blue Stars	11,000 to 25,000°C
A	Blue White Star	11,000 to 25,000°C
F	White Star	6000 to 7500°C
G	Yellow Star	5000 to 6000°C
K	Orange Star	3500 to 5000°C
M	Red Star	3000 to 3500°C

TELESCOPE

Introduction:



HOW THE EYEPIECE MAGNIFIES THE IMAGE

The glass lens has probably taught us more about ourselves and our surroundings than any other invention. Telescopes are used to see far-away objects clearly which are brought nearer.

GALILEO GALILEI was the first to make an astronomical telescope in 1609. Since then various kinds of telescopes have been developed.

Kinds of Telescopes

There are three main classes of the telescopes.

(1) Refracting Telescope

This is the simplest telescope invented by Galileo Galilei. It consists of two lenses.

The object is a larger convex lens that produces small, bright real image which is viewed through the eyepiece, placed at the end of a narrow lens, serving to magnify the image. The second lens is called the eyepiece. Refracting telescopes are simple but their strength is limited by the *size* of the lenses inside. The World's largest refracting telescope has a lens that measures one meter across.

(2) Reflecting Telescope

Astronomers usually use reflecting telescope. These contain curved mirror as well as lenses. The mirrors are able to collect more light than the lens. The mirrors in the reflecting telescopes are concave. This means that its surface is shaped like a dish and curves inwards.

When a telescope is pointed at an object, light rays from the object are collected, or focused, by the mirror. The rays are then reflected onto one or more other mirrors before being reflected into the eye piece, so that the image can be viewed.

(3) Radio Telescope

It is an instrument used in radio astronomy to pick-up and analyzes the radio frequency of electromagnetic, radiation of the extra-terrestrial sources. The two principal radio telescopes are: *(i)* Parabolic Reflector. *(ii)* Fixed Radio Interferometers.

400 YEARS OF STARGAZING
TELESCOPES OVER THE YEARS

Man has learnt more through the discovery of Lenses than any other discovery in the past. Telescopes and microscopes use lenses to explore the macro and the micro systems respectively. Telescope continues to remain the most influential scientific instrument in history that has shaped our view of the world and beyond.

A WALK THROUGH THE HISTORY OF TELESCOPES

From Refracting to Electromagnetic Telescopes

Year	Description of the Telescope with its Scope
1609	Galileo Galilei made the first refracting telescope. It was rather a crude telescope because it suffered from chromatic aberration (vision was surrounded by colours). He discovered four moons orbiting Jupiter with his telescope.
1668	Isaac Newton finally found a way to correct chromatic aberration by replacing the objective lens with a mirror that reflected light instead of refracting it so that all the wavelengths stayed together.
1845	Irish astronomen William Parsons built a record breaking 54 foot tall, four ton telescope.
1937	Telescopes could see only visible light until 1937, when American astronomen Grote Reber invented the Radio Telescope. These work on the principle of radio waves instead of lenses and mirrors.
1962	Orbiting telescope was made which gave a view of the heavens unobstructed by the atmosphere.
1990	Hubble space telescope is launched which circled 353 miles above the planet.
1999	Chandra telescope using spectrometers and camera was launched.
2013	James Webb Space Telescope

CATCH IT IF YOU CAN THE MOON IS SPIRALING AWAY SLOWLY BUT CONTINUOUSLY

Explanation:

The Moon moves a little farther away from Earth every year – but only a very short distance. Precise measurements, done by laser beam, show that the Moon is receding from Earth at a rate of 3 centimeters per year. In a million years, the Moon will have moved about 29 kilometers farther away.

LEST YOU FORGET

EASY WAY TO REMEMBER THE PLANETS IN THE SOLAR SYSTEM IN THE RIGHT ORDER

MY VERY EXCELLENT MOM SERVED US NICE PICKLES

The first letter of each world represents the name of the planet in the right order from the Sun.

MVEMSUNP

EXPANSION OF THE UNIVERSE IS GOVERNED BY THE HUBBLE'S LAW

HUBBLE'S LAW

Hubble's Law is related to the shifting of galaxies in the expanding universe. It was stated by Edwin Hubble in 1929. He worked out on the classification of galaxies and analyzed the red shifts of a number of galaxies. He noted that the speed at which a galaxy is moving away from us is directly proportional to its distance. This principle was formulated as Hubble's Law which can be mathematically written as:

$$\boxed{\text{Speed of the Galaxy} = H \times \text{Distance}}$$

Where H is Hubble's constant.

Various values for the Hubble constant have been proposed, but the generally accepted value is 56 km per second per mega parsec. A mega parsec is equal to 3.26 million light years. Thus a galaxy is receding from the earth of 56 km/sec.

FANTACY IN THE SOLAR SYSTEM

WE SEE BUT ONLY ONE FACE OF THE MOON ALWAYS

Although

THE MOON IS SPINNING AROUND ITS AXIS SINCE BIRTH

Explanation:

Although the phases of the Moon—from new moon to full moon – are constantly changing, its face remains the same. The moon has simultaneously two kinds of motions – it is spinning around its axis and it is revolving around the earth at the same time. The rotation of the moon on its axis has slowed down to match its revolution around Earth because it is subject to Earth's tidal forces. The Moon takes 27.3 days to orbit Earth and 27.3 days to rotate on its axis. This "Synchronous Rotation" means one side of the Moon always faces Earth and the other always faces away.

Since the Moon's orbit around Earth is titled 5°. 9', relative to the Sun's path on the "celestial sphere" known as the Elliptic and slight wobble, known as Libration, it allows observers on earth to see part of the Moon's far side also sometimes. In all, we can see 59 percent of the Moon's surface from the Earth; the remaining 41 percent can never be seen from Earth.

PLANETS	DIAMETER	YEAR (ONE ORBIT AROUND SUN) IN EARTH TIME	DAY (ONE ROTATION ON AXIS) IN EARTH TIME	WEIGHT OF 110-LB. (50 KG) KID
MERCURY	3.029 miles (4,878 km)	88 days	59 days	41.0 lb. (18.5 kg)
VENUS	7,515 miles (12,102 km)	224 days, 17 hours	243 days	97.0 lb. (44.0 kg)
EARTH	7,921 miles (12,756 km)	365 days, 6 hours	1 day, 23 hours, 56 minutes	110.0 lb. (50.0 kg)
MARS	4,218 miles (6,792 km)	687 days, 23 hours	24 hours, 37 min.	42.0 lb. (19.0 kg)
JUPITER	88,793 miles (142,984 km)	11 years, 11 months	9 hours, 56 minutes	276.5 lb. (125.5 kg)
SATURN	74,853 miles (120,536 km)	29 years, 5 months	10 hours, 39 min.	
URANUS	31,744 miles (51,118 km)	84 years	17 hours.14 min.	102.5 lb. (46.5 kg)
NEPTUNE	30,757 miles (49,528 km)	164 years	16 hours, 7 minutes	135.5 lb. (61.5 kg)
PLUTO	1,430 miles (2,300 km)	248 years	6 days, 9 hours, 18 minutes	5.5 lb (2.5 kg)

BEST BITS OF THE SOLAR SYSTEM

Sr. No.	Characteristic	Name of the Planet
1.	The Biggest Planet	Jupiter (Diameter 88,800 miles)
2.	The Smallest Planet	Pluto (Diameter 2500 miles)
3.	The Hottest Planet	Venus (Surface Temp. 480°C
4.	The Coldest Planet	Pluto (Frozen Snowball, –230°C)
5.	The Heaviest Planet	Jupiter
6.	The Lightest Planet	Pluto
7.	The Densest Planet	Earth (Density 5.5gm/c.c.)
8.	The Farthest Away Planet	Pluto
9.	The Closest Planet	Mercury
10.	The Brightest Planet	Venus
11.	The Faintest Planet	Pluto

12.	The Planet with brightest rings.	Saturn
13.	The Blue Planet	Neptune
14.	The Red Planet	Mars
15.	The Greenish Planet	Uranus
16.	The most colourful Planet	Earth
17.	The Planet with Longest Day Time	Venus (225 Earth Days)
18.	The Planet with Shortest Day Time	Jupiter (Ten Hours)
19.	The Fastest Revolving Planet	Mercury (Speed 110,000 miles/hours)
20.	The Slowest Revolving Planet	Pluto
21.	The Fastest Rotating Planet	Jupiter
22.	The Slowest Rotating Planet	Venus
23.	The Planet with maximum number of moons	Saturn (23 moons)
24.	The Planets with no moons.	Mercury and Venus
25.	The Planet often called the Morning Star	Venus
26.	The Rocky Planets	Earth, Mercury, Mars. Venus
27.	The Gaseous Planets	Jupiter, Saturn, Neptune, Uranus, Pluto
28.	The Planet with most eccentric orbit	Pluto
29.	The planet discovered in 20th century	Pluto
30.	The only planet with life.	Earth

THE MOST AMAZING OBJECTS

ASTEROIDS:

Asteroids are small rocky objects. These are orbiting the Sun between the orbits of Mars and Jupiter. There are several thousand of them in the asteroid belt (140 million miles wide) of the solar system. Asteroids, are also called as minor planets. The word asteroid means 'star-like' but actually the asteroids are more planet like than 'star-like'. Ceres asteroid was the first to be discovered in 1801, and is also the largest (680 miles across). The origin of the asteroids is partly connected to the remains of a planet that fell apart. Not all the asteroids orbit the Sun in the asteroid belt. Some asteroids wander closer to the Sun, sometimes passing near the Earth. These are called Earth-Grosser or Apollo-asteroids. In the past, some of these asteroids may have collided with the Earth.

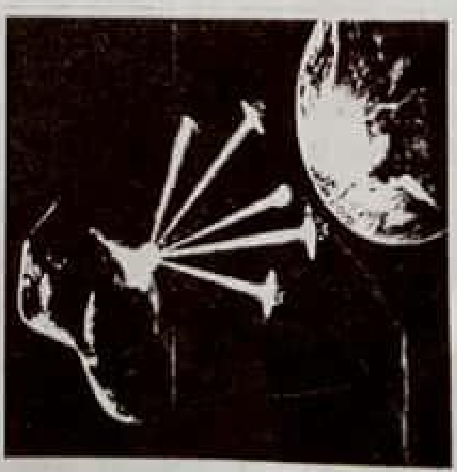


Fig: An Asteroid coming towards the Earth

METEORITES (Extraterrestrial Intruders)

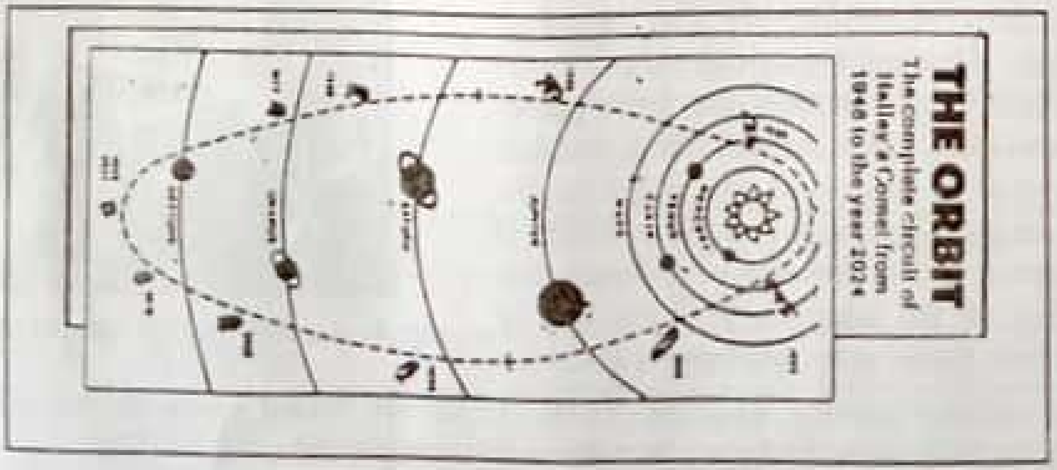
A meteorite is a tiny chunk of material floating in space that can enter the Earth's atmosphere and become a meteor. A meteor or a "falling star" is the streak of light that you can see in the night sky. A meteor will burn up or vaporise from frictional heating as it enters the atmosphere. A burning meteor is popularly referred to as a shooting star1. Most meteors burn up before they reach the ground. If they do reach the ground, they become meteorites. The Earth gets a constant meteor shower, about 5 to 10 meteors in an hour. Meteors usually become visible at about 70 mile from the Earth's surface. Larger bodies may not completely burn up in Earth's atmosphere and survive the trip through the atmosphere to Earth. They may weigh as much as 60 tons. They are formed by the disintegration of a comet or art the left-over from the birth of the solar system.

COMETS:

Comets are bodies made up of the ice and dust that move around the Sun, most of them in highly elliptic orbits. As a comet approaches the Sun, a somewhat transparent envelope and dust called the coma appears around the small compact icy nucleus. The nucleus and coma comprise the comet's head. If the comet comes within the astronomical units of the Sun, it may develop a luminous tail. The comet's head may be as large as 500,000 miles across. Comets circle the Sun in one of three types of orbits; elliptical, parabolic or hyperbolic. Comets with elliptical orbits are periodic comets, will continually orbit the Sun as do the planets. The origin of comets is unknown.

Halley's Comet:

The most famous comet is Halley's Comet, named after Edmund Halley, the first British astronomer to calculate its orbit in 1705. It visits the Sun every 76 years after. It last visited the Sun in 1986 but it passed very far from the Earth, so, its tail could not be seen with the naked eye. It will return in the year 2062.


THE ORBIT
The complete circuit of Halley's Comet from 1948 to the year 2024

THE SUN

The Sun is the central part of the *solar* system. Its surface can be studied in detail from the Earth. The Sun is very big almost a million miles across — and hot. Its important features are described below:

Composition of the Sun		Temperature of the Sun		Other Physical Constants	
Hydrogen	90%	Chromosphere	15 million C°	Mass of the Sun	2×10^{27} tons
Helium	8%			Diameter of the Sun	1.4 million km.
Heavy Elements	2%	Photosphere	6000 C°	Distance from Earth	149 million km.
				Average Density	1.4gm/c.c.

1. The Sun is about 4.6 billion years old and it contains matter in the plasma state which is the fourth physical state of matter.
2. Most of the mass (99.86%) of the solar system is concentrated in the Sun, which thus exerts the gravitational force that holds the other objects together.
3. Source of energy in the sun is due to Nuclear Fusion. This process involves the conversion of hydrogen into helium. About 616 million tons of hydrogen is converted into 612 million tons of helium in one second.
4. Every square meter of Sun's surface emits 64 million watts into space.
5. The Sun has a 27-day solar rotation period and 11-year sunspot cycle.
6. Solar wind, solar flares and sunspots are important events of the Sun.

THE MOON

It is the only natural satellite of the Earth. The Moon is at a distance of 3,85,000 km from the Earth's surface. Its important features are as follows:

1. The period of rotation of the Moon is equal to its period of revolution around the Earth. This period is 29 days, 7 hours, 43 minutes and 11.47 seconds.
2. It is 81 times lighter than the Earth and the object weigh less on the Moon.
3. It is a poor reflector (7% reflection) as compared to Earth.
4. It has 1/6th gravitational attraction as that of the Earth.
5. Craters are the most conspicuous and most plentiful of all lunar surface features.
6. Only 59% of the Moon surface is visible directly from the Earth.
7. It is rich in chromium, titanium, scandium, zirconium and yetterbium. Its average density is 3.34gm/c.c.
8. The Moon has no atmosphere.
9. The Moon has different shapes at different times of the month called phases of the Moon.
10. The average temperature of the Moon ranges from 180° to −110°C.

THE EARTH

IMPORTANT FEATURES

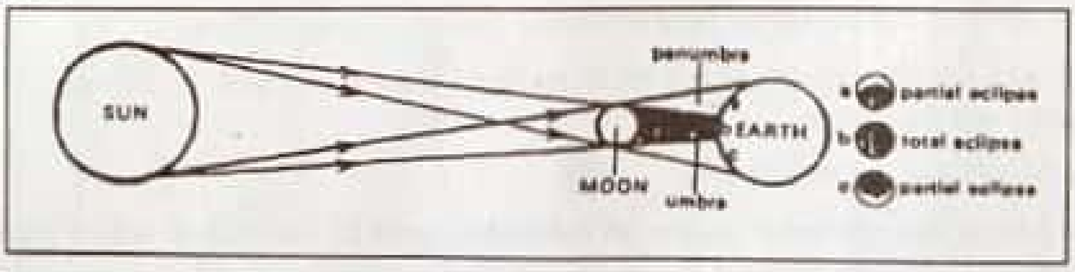
1. The exact shape of the Earth not a perfect sphere but it is an oblate spheroid.
2. It is slightly flattened at the North and South poles. It is called a Geoid.
3. Its equatorial diameter is 12,746km.
4. Polar diameter is 12,704 km.
5. The circumference of the earth at the equator is 40,232.5 km.
6. The earth is about three million miles closer to the Sun in January than in June.
7. It is about 4.6 billion years old but the life started on Earth "about 3.5 to 4 billion years ago.
8. Its rotation period is 23 hours, 56 minutes and 4 seconds and revolution period is 365% days. The $\frac{1}{4}$ day is added up to give one extra day in a leap year.
9. The Earth's axis is inclined at $23\frac{1}{2}$% degrees from the vertical.
10. Latitude and longitude coordinates are drawn on the map to locate the position of a place on the surface of the earth.
11. The International Date Line is situated at a longitude of 180° East.
12. The earth is divided into 23 full time zones and two half zones. Each zone is 15° wide and each half zone is $7\frac{1}{2}$° longitudes.
13. The average density of the Earth is 5.52 gm/cc.
14. The Earth's crust is made up of mosaic of about 15 large lithosphere plates and several minor ones that move as rigid units.
15. The atmosphere of the Earth has about 3100 cubic miles.

PROCESS OF NATURE

ECLIPSES

In nature, the shadows of heavenly bodies give rise to eclipses. Eclipses are of two types solar eclipse and lunar eclipse. The eclipses of the Sun and the Moon occur as a result of the relative positions of the Moon, the Sun and the Earth.

Solar Eclipse:



An eclipse of the sun occurs when the Moon comes between the Earth and the Sun. When the Moon moves to a position between the Sun and the Earth, it throws shadow on Earth. This shadow consists of an umbral and a penumbra. People on Earth who are in the umbral region cannot see the Sun at all. This is total eclipse of the Sun. Those in the penumbral region can see only part of the sun, and we say that they see a partial eclipse of the Sun. A total eclipse of the Sun is one of the greatest spectacles of nature and results from one of the most fortunate coincidences of nature. In round numbers, the Sun's diameter is 400 times that of the Moon, and the Sun's distance from Earth is also 400 times that of the Moon — therefore, Moon's disk appears large enough to cover the Sun's disk.

Lunar Eclipse:

An eclipse of the Moon occurs when the Earth comes between the Moon and the Sun. When the Earth lies exactly between the Sun and the Moon, it throws shadow on the Moon. This shadow is large enough to cover the whole of the Moon. A total eclipse of the Moon thus occurs. However, as the Moon moves out of the umbral region of the Earth's shadow, its appearance, as seen from the Earth goes through a series of partial eclipses.

Although lunar eclipses do not occur as often as solar eclipses, they are seen by many more people. They occur during full Moon which is opposite the Sun and can be observed at any one instant by all of the night half of the Earth.

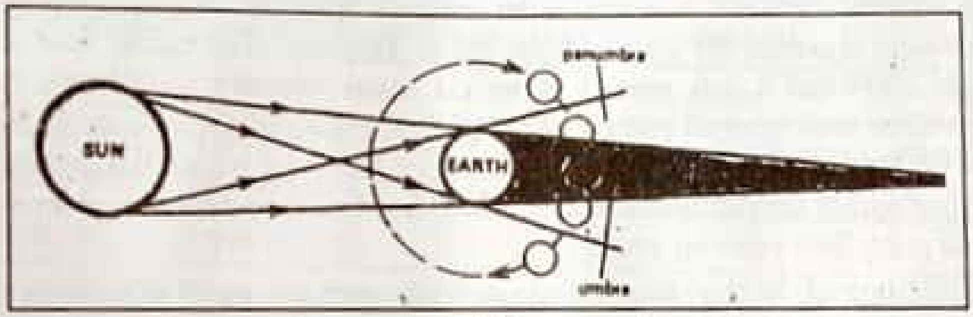


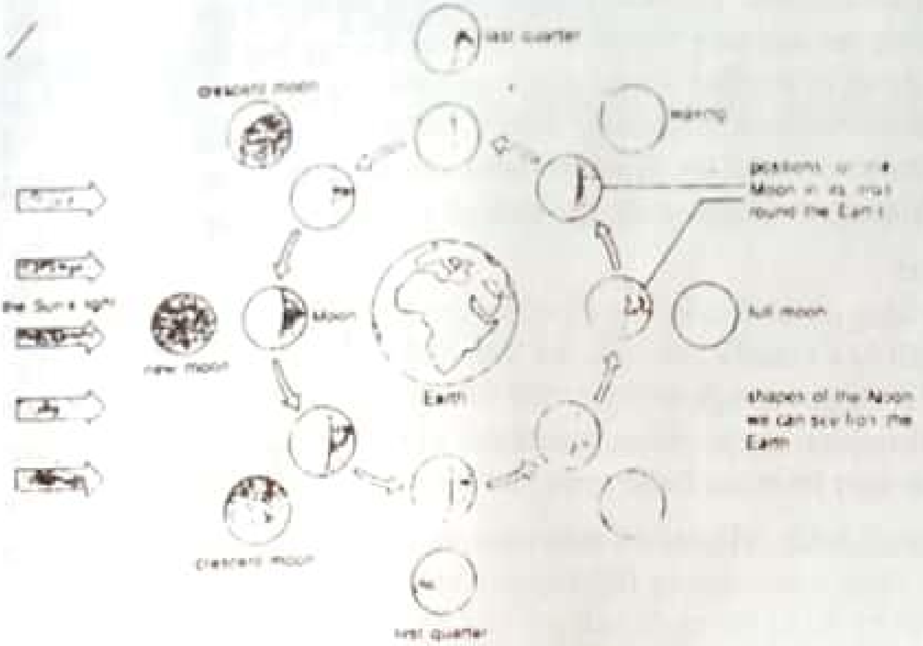
Fig.

TOTAL SOLAR ECLIPSE

Introduction:

The Moon's orbit around the Earth is elliptic and it is inclined 5 degrees to the plane of the Earth's elliptic orbit around the Sun which means that orbits of the Moon and Earth are not in the same plane. Half of the Moon's orbit is above or north of the elliptic, while the other half is below or south of it. Moreover, the equator of the Moon is inclined 6 degrees to the plane of its elliptic orbit, therefore, about 59 percent of the Moon's surface is visible at different times from the Earth. As seen from the Earth, the Moon passes through a series of phases every 27.3 days — waxing from new Moon, through first quarter to full Moon, then waning to last quarter and new moon again (see diagram).

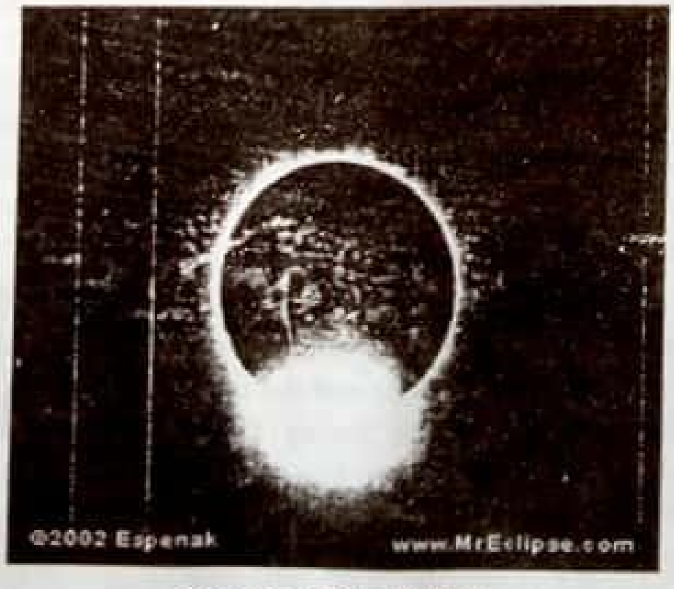
At full Moon, the Earth is between the Sun and the Moon, although not in the same plane and the whole lunar disk facing the Earth is completely illuminated. On the other hand, at new Moon, the Moon is between the Sun and the Earth, usually not in the same plane, and the rays illuminate only the hemisphere facing it, leaving the side facing the Earth in complete darkness, making it invisible from Earth. A total solar eclipse can happen only at the time of the new Moon, when the Earth, Moon and Sun are lined up, with the Moon between the other two, its night-side turned towards us.



The interval between two total solar eclipses with the largest duration of totality (about 7 minutes) is called the Saros Cycle and is 18 years. The recent total solar eclipse occurred upto 2009 and it was seen in Hawaii, Central America and Brazil. A total solar eclipse may not be seen from all parts of the world but instead it depends upon the latitude of the observer on the Earth. A total solar eclipse can be observed within the umbra region, and a partial eclipse within the penumbra region, a total solar eclipse passes over a particular spot on Earth once every 360 years on average.

The duration of the total solar eclipse depends upon the speed of rotation of the Moon and revolution of the Earth. The Moon moves eastward in its orbit at about 3400 km (2100 miles) per hour while the Earth rotates eastward at the equator at very nearly one-half that speed. Therefore, under the most suitable conditions a total solar eclipse can last at a given point near the equator for about seven and half minutes.

Any solar eclipse lets scientists make measurements that would be impossible at ordinary times.



Diamond Ring Effect

The diamond ring effect is seen during the Total Solar Eclipse of 1991 July 11.

SPECIAL FEATURES OF THE ECLIPSES

1. Eclipse of the Century July 11, 1991.
2. Rectilinear Propagation of Light.
3. Speed and formation of Shadows.
4. Different phases of the Moon.
5. At least one and 7 is maximum number of solar eclipses in a year.
6. The moon's orbit around the Earth is inclined 5° to the plane of the Earth's orbit around the Sun.
7. Shadows are like geometric cones.
8. Umbra and penumbra are the regions of Shadows.
9. Most fortunate coincidence of Nature a factor of 400.
10. The Sun has been concealed more than 100 times in this century alone.
11. First Solar Eclipse was observed about more than 4000 years ago.
12. Solar eclipse occurs at the new moon and not on the full moon.
13. A solar eclipse can therefore happen only when the new moon occurs near the two points where the lunar and Earth's orbit cross (called the nodes).
14. Maximum lunar eclipses are two.
15. On average the Earth revolves round the Sun at the speed of 1000 miles per minute.

ECLIPSES OF 21ST CENTURY

S. No.	Date	Eclipse type	Central duration	Regions
1.	June 2001	Total	4 min 57 sec.	America, Africa
2.	Dec 2001	Annular	0 min 53 sec	America
3.	June 2002	Annular	0 min 23 sec	Asia, Australia
4.	Dec 2002	Total	2 min 04 sec.	Africa, Antarctica
5.	May 2003	Annular	3 min 37 sec.	Europe, Asia
6.	November 2003	Total	1 min 57 sec	Australia, New Zealand
7.	April 2005	Hybrid	0 min 42 sec	N. Zealand, S. America
8.	March 2005	Total	4 min 7 sec	Africa, Hawaii
9.	July 2010	Total	5 min 20 sec	America

THE MYSTERY OF STONEHENGE

The arrow of time tells us that the lust for sizzling beauty and strong desire for understanding the order of this Universe by men have travelled together over the centuries.

And it is the fibre of innovation which has brought revolutions over the years.

Such a typical Innovation is the example of the Stonehenge to the Hubble Space Telescope. Over 4100 years ago, Neolithic people built a remarkable monument on the Salisbury plain in what is now Southern England.

An Engineering feat alone, Stonehenge stands as one of the wonders of the world.

With Stonehenge, they could predict eclipses, the exact days of the solatices, the long term cycles of the moon and the Sun and other heavenly events.

DAY-NIGHT AND SEASONS

The Earth's Rotation: Formation of Days and Nights:

The Earth's axis is inclined at an angle of 66½ degrees to the plane of its orbit around the Sun or the axis is inclined at $23^1/_2$ degrees from the vertical. The Earth makes two kinds of movements which take place simultaneously: **Rotation** and **Revolution**. What causes day and night is simply the rotation or spinning of the Earth on its axis. The Earth rotates from West to East as the other heavenly bodies do. It would appear then that the sun rises in the East, travels across the sky and sets in the West. At any moment of its rotation, half the surface of the Earth faces the Sun and receives its light, while the other half is in total darkness. If the Earth's axis was not tilted to one side, every place would have 12 hours of daylight and 12 hours of darkness. We know, however, that this is not so except for places on or near the Equator because the Earth's axis is inclined and hence the distribution of day-time and night time in a day is uneven. Any place along the equator has nearly 12 hours of each day and night, (Singapore is an example), whereas away from the Equator, the lengths of day and night vary according to latitude and the prevailing seasons.

At places north and south of the equator, day and night are unequal in length except during the equinoxes when all parts of the Earth have equal days and nights. The Sun remains overhead at the Equator on the spring and autumn equinox and therefore days and nights are equal in length all over the Earth's surface at this time of the year. After spring equinox (March 21st) places north of the equator begin to have longer days and shorter night. In the southern hemisphere, the opposite of this takes place, and the days get shorter and the nights longer. Around June 21st when the mid-day Sun is overhead at the Tropic of Cancer, places north of the equator have long days and short nights. The length of the daylight increases polewards, so that at the Arctive Circle ($66^1/_2$°N latitude) and beyond, there is no night and daylight last for 24 hours. This is why these places are usually referred to as the "Lands of the Midnight Sun". In winter, the conditions are exactly reversed. Therefore, it is possible to see the midnight Sun within the Arctic and Antarctic Circle.

The Earth's Revolution: Formation of Seasons:

In places near the Equator, there is little difference between the temperatures at different times of the years. This is because the Sun shines always overhead, or almost so, throughout the year. These regions therefore, do not really have the four seasons—spring, summer, autumn and winter — while places away from the equator as England and New Zealand experience. On June 21st. the position of the Earth in its orbit is such that the North Pole is tilted towards the Sun and the noonday Sun shines vertically overhead at the tropic of Cancer ($23^1/_2$°N). At the same time, the southern half of the Earth is tilted away from the Sun. This condition in Summer Solstices. In the southern hemisphere, the opposite takes place. It is mid-winter and the days are shorter than the nights. By December 22nd, the Earth has travelled halfway along its orbit round the Sun and the North Pole is now turned away from the Sun. The noonday Sun now shines vertically overhead at the tropic of Capricorn (23$^1/_2$ °N). At this time, known as the Winter Solstices, the northern hemisphere is in the midst of its cold season. The days are shorter and the nights are longer.

WEATHER

Introduction: Weather may be defined as the day-to-day condition of the atmosphere in terms of temperature, rainfall, sunshine and wind. It is often localized. The Earth is surrounded by a thick blanket of gases called the atmosphere which consists of six parts but the very lowest layer is involved in determining the weather conditions.

Climate: Climate is the average weather conditions over a long period of time. There are several different kinds of climates stretching across the world and each has its distinctive pattern of temperature and rainfall. Typical examples are:

(i) British climate
(ii) Mediterranean climate
(iii) Equotional climate
(iv) Hot desert climate
(v) Cold climate

Major Climate Zones in Pakistan
Highland climate Lowland climate Coastal climate Arid climate

Difference between Climate, Weather and Seasons:

Although sometimes the terms weather, climate and seasons are used synonymously but they differ from one another. Weather and climate are about the same things – temperature, rainfall, wind speed, sunshine and the amount of clouds taken as elements for both of them. Yet difference is one of time scale. Weather is the condition of the atmosphere today or tomorrow, whikst climate is the average weather over a long period of time.

Several different climates exist around the world. Some are the same throughout the year whilst others have seasonal differences. For example, near the equator, almost every day is hot and sunny, with heavy rain the afternoon. The Mediterranean climate, on the other hand, has seasonal differences, with dry summers and wet winters which is opposite to parts of Africa and South-East Asia where summers are wet and winters dry.

Although climates vary a great deal around the world, large areas have similar characteristics, which enables climatic regions to be identified.

Weathers Generate in Troposphere:

Major part of the atmosphere is calm and unchanging as space beyond. But the very lowest part, from sea level to about 10 km high in which we live and breathe is in constant motion, boiling and bubbling in the sun's heat like a gain kettle on a fire. It is this constant suirling and stirring of the lowest layer of the atmosphere, called the troposphere, which gives us everything we call weather, from the warm, still days of summer to the wildest storms of winter. Therefore, weather only occurs in the sphere, because this layer contains the most water vapours. Without water vapours, there would be no clouds, no rain or snow – and hence no weather.

Weather Variables

There are five main variables or elements for the formation of weather namely, temperature, pressure, circulation, precipitation and humidity. Each variable contributes in the behaviour of the weather and further depends upon number of factors which affect it. These are described below in detail.

Temperature:

Temperature is the most important element in determining the weather conditions of a place. Diversity of temperature in various places is due to the following factors.

Latitude:

The amount of heat which a place will get from the sun depends upon its latitude. Places which are closer to the equator are much warmer than places which are nearer to the poles. The following three factors are responsible for this:

(i) The curvature of the Earth

(ii) The angle of the Sun in the sky.

(iii) The layer of the atmosphere that surrounds the Earth.

The sun is always at a high angle in sky at the equator, so when it is overhead, it shines vertically downwards. The heat is concentrated over small area which therefore warms up rapidly and becomes very hot. Going towards the poles, the Sun's angle in the sky decreases. So the rays now have a greater area to heat, therefore, temperature remain much lower than at the equator.

Distance from the Sea:

Sea and land respond differently to temperature. The land heat up quickly, but also loses heat quickly. In contrast, the sea heats up and cools down much slowly. In this way it can have two main effects on weather.

(1) Great range of temperature is exhibited by the places which are far from sea. In summer they heat up quickly and become warmer than expected which in winter, they rapidly lose their heat and become very cold.

(2) Places near to the sea have a small range of temperature. This is because in summer, the sea warms up very slowly and temperature remain lower than might be expected. In winter, the sea retains much of its heat and warms the coastal area so that they enjoy relatively mild temperatures.

Prevailing Winds:

The prevailing wind is the direction from which the wind is most likely to come. The temperature of the wind depends on its source and the type of surface over which it passes. If the wind blows from the land, it will be warm in summer but cold in winter. If, as in Britain, the prevailing wind comes from the sea, it will lower temperatures in summer but raise them in winter. This also helps to explain why places in Britain have cooler summers and mild winters than places further east into Europe.

Altitude:

Mountains have much lower temperatures than the lowlands around them. For every low metres in height, the average temperature decrease is by 10°C. This is because as height increases, the air becomes less dense and is less able to retain the heat it receives from the ground.

Pressure:

The movement of the winds is linked with the prevailing pressure in the air. The fluctuation in atmospheric pressure change the weather considerably. The areas can be divided into two categories.

High Pressure Area:

High pressure area means the region where the pressure is greater than its surroundings. In this region the air spills towards and influenced by the rotation of the earth, tends to till clockwise rightwards in northern hemisphere and anticlockwise leftwards in southern hemisphere. As the air tends to sink, the weather is usually sunny or somewhat cloudy.

Pressure Ridge:

The pressure ridge area is the region where the pressure is greater than the three sides but lower than the other side of its surroundings. It is called because the three sides with greater pressure from a convex resembling the ridge stretching along the tops of a line of high mountains.

The Sub-tropic High Pressure:

This is high pressure between the tropical and temperate zones (the north pacific sub-tropic high is an example). The location and intensity of this high pressure vary with the seasons. In the regions under its control, as the air tends to sink, clouds or rains are rarely observed, but on the borders precipitation occurs frequently. The variation of location and intensity of the north pacific sub-tropic high has a heavy bearing on the droughts, floods and typhoons in China.

Low Pressure (Depression)

Low pressure area means the region when the pressure is lower than its surroundings. In this region the air flows inwards and, influenced by the rotation of the earth, tends to tilt anti-clockwise rightwards in northern hemisphere and clockwise leftwards in southern hemisphere. As the air tends to rise, the weather is usually cloudy, rainy or very windy. There are two fronts in a typical depression.

Warm Front: The warm front, which passes first, is where the advancing warm air is forced to rise over the cold air.

Cold Front: The cold front, which is where the advancing cold air undercuts the warm air in the front of it.

PRECIPITATION / RAINFALL

All kinds of precipitation begin with the cooling and condensation of water vapours. When water drops become too heavy to float, they fall to the earth and this process is called precipitation. The forms in which precipitation reaches the ground (solid or liquid) are related to the temperature outside and inside the clouds, the vapour content in the clouds and the speeds at which air moves upwards in the clouds.

Various Forms of Precipitation:

There are many forms of precipitation. Rain, drizzle, snow, snow pellets, snow grains, ice needle, hail, rime, glaze etc.

Rain: Rain is the familiar form of precipitation. It usually falls from cumulinimbus, alto-stratus clouds. Somber, slate grey clouds are a sure sign of coming rain. Clouds like this are dark because they are deep and full of water and no sun-light penetrates them. The heaviest downpours fall from the dupest, darkest clouds with all the raindrops ranges between 0.5 to 6.0 mm, larger from the cumuliform and smaller than stratiform clouds. Drops larger than 6mm are rarely observed on the ground because during falling they either get broken easily or practically do not grow to such a big size at all.

Types of Rainfall:

Generally there are three types of rainfall:

(i) Relief Rainfall:

In each case warm, moist air is forced to rise and cool. Condensation causes rain to form, or snow if the temperature is below freezing point. The main difference between the three types of rainfall is what causes or forces, the warm air to rise.

Relief rainfall is related to the height of land. It occurs where moist unstable air moves up, say, a mountain or scrap edge, and it is chilled. This chilling cause heavy condensation and precipitation, on the windward side. The lee slopes tend to receive sinking, warming air, and a dry "Rain shadow" area lie leeward of the barrier.

Examples of Relief Rainfall

Pakistan relief rainfall is experienced in most of the high altitudes areas of Pakistan except for the rain-show areas like Gilgit when annual rainfall is not more than 125 mm.

Britain: Britain received relief rainfall throughout the year due to the:

(a) Prevailing south-westerly winds which bring warm, moist air from the Atlantic Ocean.

(b) Presence of coastal mountains force the air to rise and cool.

West coasts receive more rain than east coasts due to the prevailing winds coming from the southwest.

(ii) Frontal Rainfall:

When a warm mass of air meets a cold mass of air, frontal rainfall results. As the two air masses have different temperatures, they will have different densities and so do not mix easily. The boundary between warm and cold air is called a front. As warm air is lighter than the cold air, it is forced to rise over the cold air. Frontal rain occurs in depressions which form west of Britain, over the Atlantic Ocean. In a depression warm, moist air from the tropics is forced to rise over colder, driver air from polar regions.

(iii) Convectional Rainfall

Convectional rainfall is caused by the sun heating the ground. The heated ground will in turn, warm the air which is in contact with it. As the air warms, it gets lighter and is forced to rise in strong upward convection currents. Water on the ground's surface will evaporate and it will also rise. As the warm, moist air rises in convectional currents, it cools and often gives thunderstorms. Storm winds accompanying the storms may pick up dust as well conventional rainfall, which occurs most afternoons on the equator, is most likely when the sun is at high angle in the sky.

Convectional Rainfall in Pakistan: Only the northern and north-western areas of Pakistan receive rainfall from conventional currents. But southern Pakistan is deprived of convectional rainfall due to temperature inversion layer. Criss-cross system of warm layers creates a temperature inversion layer which does not allow the condensation to take place at the height of about 1600 meters. As a result warm air descends back and no rainfall occurs. This is the reason that Karachi and adjoining areas do not receive convectional rainfall although the maximum daily temperature crosses 40°C in the month of May/June and October.

Concept in Convectional Currents:

"Temperature Inversion Layer to the South of Pakistan does not allow convectional rainfall to take place despite high ground temperatures"

Britain is usually too cool for the convectional type of rainfall apart from places in the east and southeast which have the highest summer temperature. This explains why July is often the wettest month in the east of Britain.

Rainfall from Western Depressions:

Western depressions are the cyclones which originate in the mediterranian sea, travel across Afghanistan and Iran which then reach the western areas of Pakistan. These winds cause the rainfall in these areas from December to March. A typical example is that of Quetta which receives most of its rainfall in winter seasons.

MONSOON RAINS

The word monsoon means a season. Monsoon rains are caused by Monsoon winds which are seasonal and they blow during summer and winter. Monsoon winds are seasonally reversed and driven by the temperature differences between land and sea. The summer winds are called southwest monsoons also called as giant sea breezes. They bring heavy rainfall. The rains begin when summer sun heat up tropical land masses faster than the surrounding oceans. North monsoons blow from the land towards the sea. During winter a high pressure area is created over the tropic of cancer. Winds blow from land to sea, which is a low pressure area. These winds are mostly dry and bring no significant change because they originate in a dry area.

The monsoon comes in May when the winds blow from the bay of Bengal. It crosses Bangladesh and northern India and the tail end of the wind enters northern Pakistan. The winds normally start to blow in June and cause heavy rainfall in northern Punjab in July and August. September is usually the end of the monsoon season.

Monsoon Region:

Monsoons affect large areas of the tropic and the sub-tropics from northeast Australia to the Caribbean. Asian monsoons are the most extreme, because Asia is so vast.

CLOUDS

The sun heats the ground and the warm air with moisture rises until it is cooled down high in the air. It is here water vapours condense to form a cloud. Clouds float across the sky in all sorts of shapes, sizes and colours, from white wispy mares tails to towering, lead-gray thunder-clouds.

Classification of Clouds:

Howard in 1803 identified ten distinct categories of clouds, all of which are actually variations on three basic cloud forms:

(i) Puffy cumulus clouds
(ii) Stratus clouds forming in layers
(iii) Feathry cirrus clouds

This system proved so simple and effective that it is still used by meteorologists today. Ten categories of clouds are based on their height from the sea level. For convenience of research and application, clouds are usually grouped under three main categories according to the altitude of their bases, namely.

The High Clouds
The Middle Clouds
The Low Clouds

In the light of their appearance, structure and formation, they are classified into 11 types.

From Cloud Droplets to Rain Drops Mechanism

It is well-known that precipitation comes from clouds, but why some clouds prove precipitation while others do not? The key point is the mechanism that makes the cloud droplets to grow. The basic difference between cloud droplets and precipitating particles of rain, snow, hail etc lies in the size of water drops. The size of a cloud droplet averages only several microns in diameter, but a small rain drop measures about 1mm (1000 microns). As the mass and volume of water drop is proportional to the third power of its diameter, to make a single rain drop of 1mm would require 1,000,000 cloud droplets of 10 microns.

The following two theories explain the growth of cloud droplets into rain drops in a given span of time and then overcome the upward pull of the rising air so as to fall down to the ground.

(1) The theory of Triple-phase transformation:

Water can exist in liquid, solid or gas phase simultaneously. This is what happens in the cold clouds. As the temperature between the top and bottom of thick mass of cloud may differ to an extent of dozens of degrees, particles in the mass may include ice crystals, water drops, and super-cooled water drops which remain in liquid state below $0^{\circ}C$. This is the triple-phase co-existence (ice, water and gas) in the cloud.

This process of the growth of small ice crystals into precipitating particles due to triple-phase transformation of water is called the triple-phase transformation theory of precipitation.

(2) The Theory of Coalescence:

In the tropics, precipitation also occurs, even in considerable amounts, from cumulus clouds which are warmer than $0^{\circ}C$ and thus devoid of the triple phase co-existence of water. This kind of precipitation from warmer clouds is explained by the theory of coalescence.

The principle of coalescence is very simple. As the condensation nuclei in the air are different in sizes, the cloud droplets formed on them are different in size. Moreover, the upward motion of air and the contents of moisture in the cloud are not uniformly distributed,, so in different circumstances, the cloud droplets grow at different rates. Whether descending due to the upward pull of rising air, or ascending due to gravity, the larger droplets drop quicker and rise slower than the smaller ones. This difference is speed makes it possible for the larger droplets to coalesce with and "swallow" up the smaller ones.

HUMIDITY

Humidity is another important weather variable which also interacts strongly with other climate variables like temperature and pressure. Humidity is the amount of water vapour in the air. Water vapour in the gaseous state of water and is invisible. The greater the vapour content in the air, the higher is the humidity. At a given temperature, a given volume of air can hold only a given amount of water.

If vapour content stays equal or rises above what the air can hold, we say the air is saturated or supersaturated. In saturated air, water ceases to evaportal and wet clothes cannot get dry.

Humid Weather: We feel uncomfortable in a humid weather as it becomes unbearably stuffy in summer or gloomy cold in winter. We feel equally uncomfortable when the humidity is very low. People from south may suffer from excessive dryness of the mouth cracking of the lips or even bleeding from the nose when they put their finger in the nose. Higher humidity reduces the effectiveness of sweating in cooling the body by reducing the rate of evaporation of moisture from the skin. This effect is calculated in a heat index table or humidex.

Measurements of Humidity:

There are three main measurements of humidity described below:

(1) Absolute Humidity

Absolute humidity is the total mass of water vapour present in a given volume of air. It does not take temperature into consideration. Absolute humidity in the atmosphere ranges from zero to roughly 30 grams per cubic metre when the air is saturated at 30°C.

Absolute humidity is actually the ratio of the mass of the water vapour to the volume of the air and water vapour mixture. Its value changes as air temperature or pressure changes. The field concerned with the study of physical and thermodynamic properties of gas-vapour mixtures is named psychometrics.

(2) Relative Humidity:

The relative humidity of an air-water mixture is defined as the ratio of the partial pressure of water vapour in the mixture to the saturated vapour pressure of water at a given temperature. Thus, the relative humidity of air is a function of both water content and temperature. Relative humidity is normally expressed as a percentage and is calculated by using the following equation.

Relative Humidity =

$$\frac{\text{mass of water vapour in a given volume} \times 100}{\text{mass of water vapour required to saturate the same volume of in the air temperature}}$$

Relative humidity is an important metric used in weather forecasts and reports, as it is an indicator of the likelihood of precipitation, dew, or fog.

Relative Humidity and Human Comfort:

The rate at which moisture evaporates from the skin depends upon three factors, namely:

(i) The temperature

(ii) The amount of water vapour present in the atmosphere

(iii) The rate of movement of air over the skin

The hot summer weather, a rise in relative humidity increases the apparent temperature to humans (and other animals) by hindering the evaporation of perspiration from the skin.

For example, according to Heat Index, a relative humidity of 75% at 26.7°C would feel like (28.7°C ±0.7°C) at about 44% relative humidity.

When the air is comparatively, evaporation from the skin takes place more easily, and faster cooling of the body takes place. Thus, in hot continental climates, where the temperature tends to be dry, high temperatures can be tolerated more comfortably than in tropical regions, where heavy rainfall leads to near saturation conditions.

From the point of view of personal comfort, the actual quantity of water vapour present in the air is not so important as its nearness to saturation or relative humidity.

There are a number of different methods available for measuring relative humidity by instruments called Hygrometers. Wet and dry-bulb hygrometer is more common for such a measurement.

Specific humidity:

Specific humidity (or moisture content) is the ratio of water vapour mass to the air parcel's total (including dry) mass and is sometimes referred to as the humidity ratio. Specific humidity is approximately equal to the 'mixing ratio', which is also defined as the ratio of the mass of water vapour in an air parcel to the mass of dry air for the same parcel.

Latent Energy of Water Vapour:

Any liquid needs heat energy to turn into a gas, and this is called its latent heat of vapourization. When the process is reversed and the gas is liquefied the same amount of heat is given out. Water has high latent heat of vapourization equal to 536 cal/gm. It may be defined as the amount of heat required to convert one gram of water into vapours at its boiling point.

When a solid is melted (e.g. ice into water) it needs to absorb a certain amount of heat energy, and when this process is reversed (e.g. water frozen to ice), the same amount of heat is given out. This is called the latent heat of fusion of the liquid.

While humidity itself is a climate variable, it also interacts strongly with other climate variables. The humidity is affected by winds and by rainfall. At the same time, humidity affects the energy budget and thereby influences temperatures in two major ways.

First water vapour in the atmosphere contains latent energy. During transportation or evaporation, this latent heat is removed from surface liquid, cooling the earth's surface. This is the biggest non-radiative cooling effect at the surface. It compensates for roughly 70% of the average net radiative warming at the surface.

Water as a Greenhouse Gas

Second, water vapour is the most abundant of all the greenhouse gases. Water vapour like a green lens that allows green light to pass through it but absorbs red light, is a selective absorber. Along with other greenhouse gases, water vapour is transparent to most solar energy, as one can literally see. But it absorbs the infrared energy emitted (radiated) upward by the earth's surface, which is the reason that humid areas experience very little nocturnal cooling but dry desert regions cool considerably at night. This selective absorption causes the greenhouse effect. It raises the surface temperature substantially above its theoretical radiative equilibrium temperature with sun and water vapour is the cause of more of this warming than any other greenhouse gas.

Water as a condensable Greenhouse Gas:

Unlike most other greenhouse gases, however, water is not merely below its boiling point in all regions of the earth, but below its freezing point at many altitudes. As a condensable greenhouse gas, it precipitates, with a much lower scale height and shorter atmospheric lifetime – weeks instead of decades. Without other greenhouse gases, Earth's Blackbody temperature, below the freezing point of water, would cause water vapour to be removed from the atmosphere.

Water vapour is thus a "slave" to other non-condensible greenhouse gases.

Most Humid Places:

The most humid cities on earth are generally located closer to the equator or near coastal areas. Cities in south and southeast Asia are among the most humid.

Kuala Lumpur Jakarta and Singapore have very high humidity all year round because of the proximity to water bodies and the equator and often overcast weather some places experience extreme humidity during their rainy seasons combined with warmth giving the full of lukewarm sauna, such as Kolkata, Chennai and Cochin in India, and Lahore in Pakistan.

Dew Point and Humidity go Together

Those who wear spectacles know that when they enter a warm room from the cold or outside air, a film of moisture is often deposited on the houses of the glasses. Similarly, a cold mirror may become dulled when brought into a warm atmosphere. In such cases the cold glass surface cools the air in its vicinity to a temperature below that for which the water present in sufficient to saturate the air. Excess water vapour then condenses out, and the highest temperature at which this can occur is called the dew point.

The Dew Point may be defined as the temperature at which the water vapour present in the air is just sufficient to saturate it.

Dew Point Competes Relative Humidity

Sukkur city located on the Indus River in Pakistan has some of the highest and most uncomfortable dew point in the country frequently exceeding 30°C in the monsoon season. High temperature couple with bizarre dew point to create heat index in excess of 65°C. Darwin, Australia experiences an extremely humid wet season from December to April.

Shanghai and Hong Kong in China also have an extreme humid period in their summer months.

Heavy rains and relatively high humidity post-rainfall is expected during the South-West and North-East monsoon seasons (respectively, late May to September and November to March). Outside the monsoon seasons, humidity is high (in comparison to countries North of the equator, but completely sunny days abound.

Forks and Olympia, Washington in U.S.A are the most humid cities, strictly in terms of relative humidity. But high humidity in this place rarely exhibits the discomfort usually expected. This is because high dew points play a more significant role than relative humidity in discomfort, and so the air in these western cities usually does not feel humid as a result.

Dew Point and Heat Index of a place are connected in a linear fashion.

Climate/humidity table

The table shows the "absolute humidity" in g/m^3 (upper line) and the "dew point temperature" of the air in°C (lower line) for certain air temperatures as a function of "relative humidity".

Example: At an air temperature of 50°C and a relative humidity of 70%, the absolute humidity is 58.1 g/m^3 and the dew point temperature is 43°C.

Relative humidity	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Air temperature [°C]										
+50	8.3	16.6	24.9	33.2	41.5	49.8	58.1	66.4	74.7	83.0
	+8	+19	+26	+32	+36	+40	+43	+45	+48	+50
+45	6.5	13.1	19.6	26.2	32.7	39.3	45.8	52.4	58.9	65.4
	+4	+15	+22	+27	+32	+36	+38	+41	+43	+45
+40	5.1	10.2	15.3	20.5	25.6	30.7	35.8	40.9	46.0	51.1
	+1	+11	+18	+23	+27	+30	+33	+36	+38	+40
+35	4.0	7.9	11.9	15.8	19.8	23.8	27.7	31.7	35.6	39.6
	-2	+8	+14	+18	+21	+25	+28	+31	+33	+35
+30	3.0	6.1	9.1	12.1	15.2	18.2	21.3	24.3	27.3	30.4
	-6	+3	+10	+14	+18	+21	+24	+26	+28	+30
+25	2.3	4.6	6.9	9.2	11.5	13.8	16.1	18.4	20.7	23.0
	-8	0	+5	+10	+13	+16	+19	+21	+23	+25
+20	1.7	3.5	5.2	6.9	8.7	10.4	12.1	13.8	15.6	17.3
	-12	-4	+1	+5	+9	+12	+14	+16	+18	+20
+15	1.3	2.6	3.9	5.1	6.4	7.7	9.0	10.3	11.5	12.8
	-16	-7	-3	+1	+4	+7	+9	+11	+13	+15
+10	0.9	1.9	2.8	3.8	4.7	5.6	6.6	7.5	8.5	9.4
	-19	-11	-7	-3	0	+1	+4	+6	+8	+10
+5	0.7	1.4	2.0	2.7	3.4	4.1	4.8	5.4	6.1	6.8
	-23	-15	-11	-7	-5	-2	0	+2	+3	+5
0	0.5	1.0	1.5	1.9	2.4	2.9	3.4	3.9	4.4	4.8
	-26	-19	-14	-11	-8	-6	-4	-3	-2	0
−5	0.3	0.7	1.0	1.4	1.7	2.1	2.4	2.7	3.1	3.4
	-29	-22	-18	-15	-13	-11	-8	-7	-6	-5
−10	0.2	0.5	0.7	0.9	1.2	1.4	1.6	1.9	2.1	2.3
	-34	-26	-22	-19	-17	-15	-13	-11	-11	-10
−15	0.2	0.3	0.5	0.6	0.8	1.0	1.1	1.3	1.5	.16
	-37	-30	-26	-23	-21	-19	-17	-16	-15	-15
−20	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9
	-42	-35	-32	-29	-27	-25	-24	-22	-21	-20
−25	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6
	-45	-40	-36	-34	-32	-30	-29	-27	-26	-25

NATURAL HAZARDS AND DISASTERS

WILDFIRES

Introduction:

Wildfires are uncontrolled blazes fueled by weather, wind and dry underbrush. In a matter of minutes, wildfires can burn acres of land and consume everything that comes in their paths. Wildfires often occur in wild, unpopulated areas, but they can occur anywhere and hard homes, agriculture, humans and animals in their surroundings.

Conditions for wildfires:

There are three conditions that need to be present in order for a wildfire to burn. This is referred as the Fire Triangle, Fuel, Oxygen and a heat source. Fuel is any flammable material surrounding a fire, including trees, grasses, bushes and even homes. The greater an areas fuel load, the more intense the fire.

Air supplies the oxygen a fire needs to burn. Heat sources help spark the wildfire and bring fuel to temperatures hot enough to ignite lightning burning campfires, cigarettes, hot winds and even the sun can all provide sufficient heat to spar a wildfire.

Favourable contributors to wildfires:

1. Dry weather and drought convert green vegetations into bone-dry flammable fuel.
2. Strong winds spread fire quickly over land and warm temperature encourage combustion.
3. A spark is only needed when the above two factors come together which may come from lightning, arson, a downed power line on a burning fire or cigarette to ignite a blaze that could last for weeks and consume tens of thousands of acres.

These violent infernos occur around the world and in most of the 50 states but they are most common in United States western part when heat, drought and frequent thunderstorms create perfect wildfire favourable conditions.

How to control wildfires?

1. Firefighters control wildfires by depriving them of one or more of the triangle fundamentals
2. Traditional methods include water dousing and spraying the retardants to extinguish fires.
3. Clearing vegetation to create firebreaks starves a fire of fuel and can help slow or contain it.
4. Sometimes firefighters also fight wildfires by deliberately starting fires in a process called controlled burning. These prescribed fires remove undergrowth, brush and ground litter from a forest depriving a wildfire of fuel.

Some benefits of wildfires:

Although often harmful and destructive to humans, naturally occurring wildfire play an important role in nature as below:

1. They return nutrient to soil by burning dead or decaying matter.
2. They also act as a disinfectant, removing disease-ridden plants and harmful insects

from a forest ecosystem.

3. Wildfires allow sunlight to reach the forest floor enabling a new generation of seedlings to grow by burning through thick canopies and brushy undergrowth.

Wild Facts about wildfires:

1. 90% of all wildfires are started by humans.
2. Firefighters give different names to wildfires, like surface fires, Dependent crown fires, spot fires and ground fires.
3. Crown fires are spread by wind moving quickly across the tops of trees.
4. Running crown fires are even more dangerous because they burn extremely hot, travel rapidly, and can change direction quickly.
5. One of the largest fires in the recent history was in 1825 when a fire tore through Maine and new burns wick, Canada burning 3 million acres of forest.
6. Wildfires can be caused by an accumulation of dead matter (leaves, twigs and trees) that can create enough heat in some instances to spontaneously combust and ignite the surrounding areas.
7. Lightning strikes the earth over 100,000 times a day. 10 to 20% of this lightning strike can cause fire.
8. Manmade combustions from arson, human carelessness or lack of fire safety cause wildfire disasters every year.
9. An average of 1.2 million acres of US woodland burn every year.
10. A large wildfire or conflagration is capable of modifying the local weather conditions.

FLOODS:

Rivers provide an attraction for human settlement and economic development. They act as resource to people for drinking, washing, industrial process, irrigation and transport. But when excessive water enters in the rivers, they overflow and cause floods. Serious floods can cause large-scale devastation.

Cause: Cause of heavy floods may be due to natural and man-made activities namely heavy rains, melting of snow during summer, lack of planning, deforestation and failure to strengthen embankments alongside rivers. Destruction of wetlands, swamps along river, is also responsible for increased flooding.

Kinds of Floods: All the floods are not alike. Some floods develop slowly; while others are FLASH FLOODS develop in just a few minutes and without visible sign of rain.

Overland Flooding: It is the most common type of flooding event which commonly occurs when rivers overflow because of excessive rains.

Flash Flooding: Flash floods can occur within few minutes or hours of excessive rainfall, a dam or levee failure, or a sudden release of water held by ice jam. Flash flood often has a dangerous wall of roaring water carrying rocks, mud and other debris.

Role of Monsoon. The word monsoon means a season. The monsoon winds are seasonal which blow during summer and winter. The summer winds are called southwest

[redacted]

monsoons which are giant sea breezes which bring heavy rainfall and cause floods in Pakistan.

People most affected by floods:

Farmers: Farmers belong to the groups which are most affected by floods because they cannot use the land until the water has drained out. Flood destroys the crops and food supplies are shortened. The farmers suffer financial losses and the general public have to pay now price of the flood which because scarce. Farmers also lose their livestock and precious belongings.

Local Residents: Local residents get their houses cut off from shops and services. Mud houses and huts get collapsed and water born diseases spread.

Transport Authorities: The roads and the railway tracks get damaged by the floodwater. This disturbs the whole system of transport and the price of the daily commodities rise.

Benefits of Floods: Floods bring devastation to an un-prepared community but it can be taken as a natural event with a purpose. Floods return nutrients to the land and contribute to the health of wetlands as in Pakistan. Floods recharge ground water supplies.

Protection against Floods: Few remedial measures to control the floods are given below:

(i) Generous planting of trees on the foothills to check the flow of running water.

(ii) Building dams, reservoirs and embankments.

(iii) Building extra channels to take flood water away from towns through storm sewers.

(iv) Strengthening of watershed management.

AVALANCHES

Introduction:

Avalanches represent a major danger only in mountainous areas of the earth where geographic and meteorological conditions give rise to heavy rains and to accumulation of snow and ice prone to hunting down in the valleys inhabited by men.

When does it occur?

The greatest danger of avalanches comes when fresh, loose snow has fallen onto a harder, icy layer. The slightest disturbance can start a slide, which crashes down into the valley, burying anything and anyone in its path. The blast of air in front of it is often strong enough to demolish buildings.

Types of Avalanches:

A distinction can be made between two types of avalanches.

Large Scale Avalanches:

Large scale avalanches are caused by very heavy rains which threaten localities, buildings and communication links in all parts of a valley. These occur spontaneously on the uphill mountain slopes and according to meteorological conditions.

Flash Avalanches:

Under the influence of masses of Artic or Antarctic winds, which cause a sharp fall in the normal temperatures, cold spells can strike even temperate regions.

Restricted Avalanches:

The damaging effects of avalanches may be widespread or limited; it depends upon the factors which initiated them. Even a much localized incident can have consequences beyond its immediate surrounding as in case of landslides, especially when communication links such as roads, railways and cables, cars are interrupted or infrastructure is destroyed. Because of the very varied characteristic of avalanches and their often serious damaging effects a full proof security system in the field is required alongwith an efficient Alarm System covering their entire territory.

Blizzards:

Blizzards occur mainly in the cold regions of the northern and southern hemisphere, when the snowfall is accompanied by strong winds. Blizzards a characterized by snowstorms accompanied by violent freezing winds which bring all life to a standstill over vast territories. Damages produced by Blizzards are similar to that produced by Avalanches.

Protection against Avalanches:

Areas at risk from avalanches can generally be identified by observation of the mountains slopes and by the study of the local records of post-disaster. Preventive measures will consist in identifying these likely zones and in the ad hoc layout, planning and implanting of buildings to prevent the triggering of serious avalanches. Anchoring and retaining devices should be positioned not only on the mountain slopes but also integrated in the infrastructure (walls, retaining or diverting channels, tunnels, galleries, etc.) built to protect treatment property. Planting trees is also an effective preventive measure.

Intervention and Rescue Measures:

As soon as the risk of an avalanche becomes apparent, especially in view of the thickness and structure of the snow and the evolution of the weather conditions, local, regional or national authorities should take the specific protection measures required by the situation.

(i) Observation and alarm service.

(ii) Closing off the area under threat.

(iii) Banning road and rail traffic.

(iv) Informing the population.

(v) Evacuation of all or some of the population alongwith their property and livestock if needed.

WIND STORMS

Introduction: The wind is air in motion one of the major forms in which energy is exhibited nature. Wind has different names when it blows like northerly, southerly, strong a weak because the atmosphere present is not uniform. Just as water flows from higher to lower locations, air also moves from higher pressure to lower pressure regions. Therefore, the larger the pressure difference, the greater is the pressure gradient, the faster the air moves and consequently the harder the wind blows.

GLOBAL AIR CIRCULATION GENERATES STRONG WINDS:

The global air circulation is operated by the transfer of heat. The motility for the formation of winds is the sun. The heat bestowed to the earth by the sun is unevenly distributed on the surface of the earth. The heat received at the equator and lower latitudes is for greater than that received in Polar Regions. It is this unevenness of distribution of heat that sets the huge machine atmosphere in motion. The air gets heated on both sides of the equator, and rises, flows outwards, cools somewhat and then sinks towards the earth in the vicinity of 30° latitudes.

Similarly, at the poles, cold air inks, gradually gets heated and then rises again to repeat the cycle.

Middle Latitude Cell:

Between these two thermally generated cells, there is a middle latitude cell. In this cell, the wind circulation operates in reverse, like part of a gear train, with an upward thrust of the polar air on one side and a downward pull of tropic air on the other.

TRAVELLING CYCLONES

Introduction:

Cyclone may be defined as a system of winds rotating towards an area of low barometric pressure with an anticlockwise (northern hemisphere) or clockwise (southern hemisphere) circulation. Winds blow inwards in the area of low pressure of the atmosphere to fill the depression and adopt a spiral pattern because of the Corvallis Effect.

Corvallis Effect:

It is the apparent force acting on an object moving across the Earth's surface, due to the Earth's rotation. The apparent velocity of an object at rest on the Earth's surface rise from zero at the poles to a maximum at the equator. When moving away from the equator, an object appears to deflect to the right in the northern hemisphere. Consequently, an object moving in a north-south direction also appears to be moving east to west. The carioles effect is responsible for the pattern of winds and ocean currents.

TROPICAL CYCLONES

The tropics experience some of the fiercest and most destructive windstorms on Earth. The meteorologists call these wind storms as tropical Cyclones, known as TYPHOONS in the pacific or sometimes willy-nilly. Tropical cyclones or Hurricanes (local name) claim more lives each year than any other storms. When a full-blown hurricane strikes, trees are uprooted and buildings are flattened by raging winds gusting upto 360 kph. Vast areas are swamped by torrential rain, and coastal surge. This is a wall of water some 25 ft high, sucked up by the storm's eye" the ring of low pressure at the storm's center and tapped by giant waves whipped up by the winds.

Formation of Hurricanes:

Hurricanes begin as small thunderstorms originating over warm tropical oceans close to the equator. They are the most common in late summer or autumn when sea temperatures are at their highest (at least 26°C). At these temperatures water evaporates rapidly and as the rising air cools, it condenses and releases enormous amount of heat energy which actually powers the storm.

Soon, several storms may cluster together and whirl around as one, encouraged by strong winds high in the atmosphere. Then they daft westward across the ocean, drawing in warm, moist air and spinning in ever tighter circles.

Anatomy of a Hurricane:

The sequence of the formation of a hurricane over the Pacific Ocean may be described as under:

(i) Thunderstorms develop over the sea.
(ii) Storms group to form a swish of cloud.
(iii) Winds grow distinct center forms in cloud swirl.
(iv) Eye forms, typhoon is at its most dangerous point.
(v) Eye passes over land; typhoon starts to die.

Once the hurricane reaches land, the friction of the ground and the storm quickly declines in strength and eventually blows itself out.

Damage caused by Hurricanes:

Hurricanes are a major natural hazard. Their effects can be catastrophic, causing widespread damage to property, disrupting communications, destroying crops and resulting in considerable loss of life. The most dangerous feature of the hurricane is the storm surge. This occurs at the Eye of the storm when very low pressure causes the sea-level to rise upto 10 meters. The resulting high seas and tidal waves lead to serious flooding of low-lying coastal areas close to the hurricane tracks.

The extent of the damage and loss of life caused by tropical storms varies and is closely related to the stage of development of the affected area. Porter countries suffer more because their buildings, warning systems, defenses and emergency services are inadequate. Wealthier countries, however, can afford to prepare of such disasters and so minimize the potential destruction and loss of life.

Hurricane Watch:

Meteorologists can detect hurricanes through satellite images when they are far from land, and track them as they approach. Special aircrafts repeatedly fly through the storm to obtain accurate measurements that help predict its violence and likely path.

TORNADOES

Introduction:

Tornadoes go by many names:

Twisters, Whirlwinds and more.

Tornado may be defined as a mobile destructive vortex of violently rotating winds having the appearance of a funnel shaped cloud and advancing beneath a large storm system. It is the most furious of whirlwinds on the Earth. Whenever they strike, these whirling spirals of wind leave a trial of unbelievable destruction.

Configuration of a Tornado:

It is very singular in shape, resembling a funnel hanging down the mother body of thunderstorm clouds, or an elephant's trunk swinging in the sky. When a tornado is impending, there are dense and dark masses of cloud rolling in the sky, accompanied by green flashes and low deep rumbling. When it showing up, the rumbling becomes deafening, like a train of hundreds of carriages howling along at full speed, or hundreds of beasts of prey roaring in a desperate graph.

Intensity of the Tornado:

Meteorological instruments rarely survive to tell what conditions are really like a tornado. Winds probably race around the outside at over 400 kph, while pressure at the centre plunges hundred millibars lower than outside. This creates a kind of funnel, or vortex that acts like a giant vacuum cleaner, sucking things into the air tearing the tapes off trees and blowing out windows. The tornado is small in scale (about 100–1000 m in several hours) and medium in travelling speed. Sometimes it disappears after a travel of only several tens of meters, but sometimes sweeps as for as several hundred kilometers.

Damage Caused by Tornado:

Tornadoes are extremely destructive. They sweep oft sand and stones, pull up trees and smash buildings of solid structure to dust. The United States of America is harassed by the largest number of tor in the world. It happened in 1931 that in Minnesota (USA) a tornado lift a 83-ton railway carriage, with 117 passengers and then put it gently down in a gully over 200 meters away without any damage either to carriage or to the passengers.

Fish Rain

At times the tornado sweeps fishes and shrimps in the sea, frogs in rivers or grains in barns up into the sky and then sends them down to the ground with rain gushes, creating such interesting phenomena as Fish Rain, Shrimp Rain, Frog Rain, Pulses Rain, Grain Rain and so on.

DROUGHT

Introduction:

Drought is an insidious hazard of nature and may be defined as a long period of weather that is drier then usual. Lock of rainfall results in severe water shortages and the drought lasts for a particularly long time becoming a climate hazard causing problems for people. Drought brings famine, diseases and death on a massive scale and the poorer countries are the hardest hit. An accurate definition is difficult to be narrated, because what may be considered a drought in, say, Bali (six days without rain) would certainly not be considered a drought in Libya (annual rainfall less than 180 mm).

Types of Drought. There are four different categories of drought.

(i) ***Permanent Drought:*** It exists when crop cultivation is not possible without irrigation some typical parts of Pakistan are Thal, Cholistan and Chagai in western Balochistan. Such severe droughts badly affected Ethiopia, Sudan, Chad, Niger and Mali.

(ii) ***Seasonal Drought:*** It occurs in areas with well defined rainy and dry seasons like Potwar Plateau and Southern Punjab.

(iii) It is the result of a water deficiency that reduces crop yields but is not severe enough to destroy them.

(iv) ***Unpredictable Drought:*** It occurs in the areas where there is abnormally low rain and has humid climates.

Main Causes of Drought: Main causes of the drought can be put into the following two categories:

1. ***Natural Factors:*** Unreliability of monsoon winds may lead to seasonal drought in Punjab and Sindh. The dry and hot winds can reduce the moisture contents of the sandy soil by lowering the level of the humidity in the air. Moreover Global Climate is constantly changing leading to changes in Pakistan's climate.
2. ***Human Factors:*** Deforestation on the foothill of mountains increases soil erosion and this reduces rainfall. Mismanagement of water resources through seepage of unlined canals and unfair distribution of water between the provinces leads to drought situation. Overgrazing of land leads to soil erosion which reduces soil fertility.

	EFFECTS OF DROUGHT	
	Developing countries	**Developed countries**
(i)	Farming land dries out	Farming land dries out
(ii)	Animals die and crops fail	Reservoirs become empty.
(iii)	People starve, farmers lose income	Water supply is difficult and costly.
(iv)	People die or migrate	Emergency measures are taken
(v)	Foreign Aid has to be given to people	Water storage capacity is increased and less water consumption is encouraged.

Long-Lasting Effects:

Like an insidious plague, drought builds slower, spreads farther, lasts longer and touches more lives than any other natural disasters. Drought's impact ripples like heat off pavement. Crops die, food costs soar, livestock store, water tables drop, fires rage and heat takes human lives.

TSUNAMI

Introduction:

A Tsunami (pronounced sue-nahm-ee) is a series of huge waves caused by an underwater earthquake, a volcanic eruption, a submarine rockslide or more rarely by an asteroid or meteoroid crashing in the water from space. The word tsunami comes from the Japanese word meaning "harbor wave".

Cause of Tsunami:

Most Tsunamis are caused by underwater earthquakes, but not all underwater earthquakes because tsunamis – an earthquake has to be over for it to cause tsunami. About 90 percent of all tsunamis occur in the Pacific Ocean. Tsunamis are sometimes called "tidal waves" incorrectly because these are not caused by the tides which are actually caused by the gravitational force of the moon on the sea. Regular waves are caused by the winds. Oceanographers call tsunamis seismic sea waves. Whatever their name, those who have lived through them call them killers.

Arrival of Tsunami:

Many tsunamis could be detected before they hit land and the loss of life could be minimized, with the use of modern technology, including seismographs computerized offshore buoys that can measure changes in wave height, and a system of sirens on the beach to alert people of potential tsunami danger.

Indication of Tsunami:

If you see the water recede quickly and unexpectedly from a beach (this is called drawback), run toward higher ground or inland there may be Tsunami coming. The some precaution may be observed if there is an earthquake and you are on the coast. Some beaches have tsunami warning sirens – these should not be ignored. The first wave in a tsunami is often not the largest, if you experience one abnormally huge wave; go inland quickly even bigger waves could be coming soon.

How large are the waves?

A tsunami starts when a huge volume of water is quickly shifted. A tsunami could pass under your boat if you were out to sea because the bottom is so deep. But as the wave gets closer to land, the ocean becomes shallower and begins to cause the wave to crest. Some tsunamis can top 100 feet by the time they reach the shore. The largest tsunami ever measured was 212 feet. Tsunamis have an extremely long wavelength and can travel as fast as 1000 km per hour in the open ocean as fast as a jet flies. It is important to remember that a tsunami is usually made up of several waves moving together. The distance from the crest of one wave to the crest of another can be as much as 160 km. So a large wave could hit, followed an hour or so later by another and an hour after that by still another. It can take only a few hours for a tsunami to travel across an entire ocean. A regular wave (generated by the wind) travels at upto about 90 km / hour. In the deep sea, a tsunami's height can be only 3 feet tall; therefore they are often barely visible when they are in the deep sea. This makes tsunami detection in the deep sea very difficult.

PICTORIAL REPRESENTATION OF THE DEVELOPMENT OF A TSUNAMI

津 tsu = harbor
波 nami = wave

START OF THE TSUNAMI

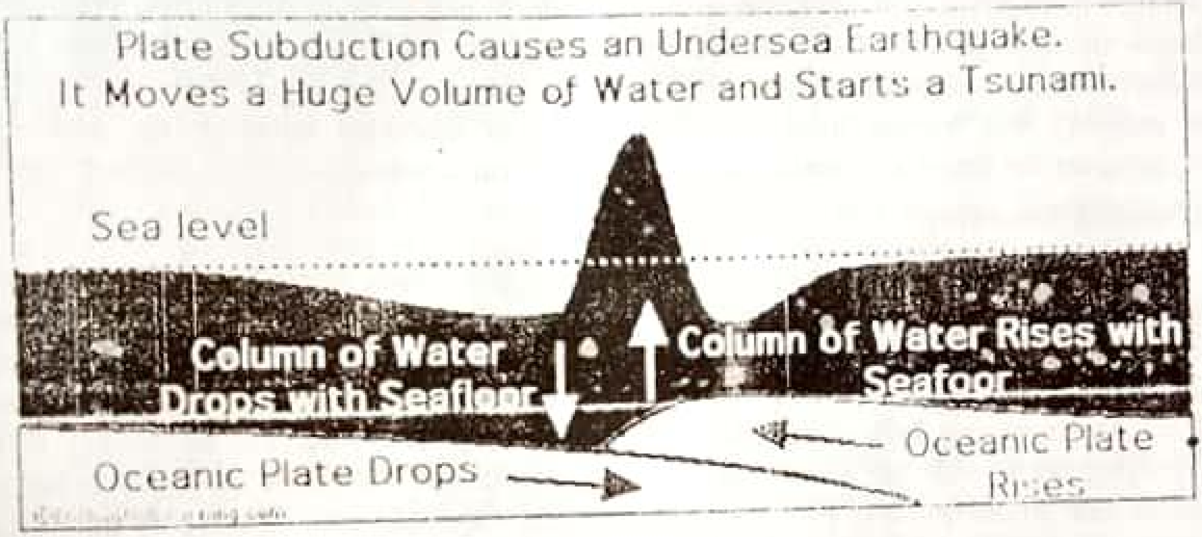
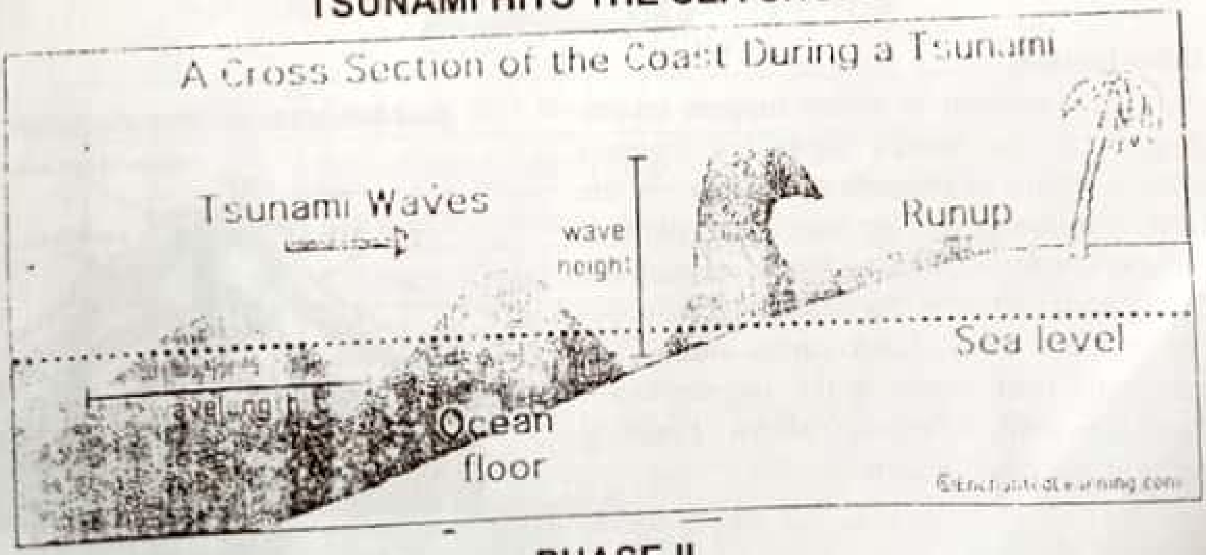


Plate Subduction Causes an Undersea Earthquake.
It Moves a Huge Volume of Water and Starts a Tsunami.
Sea level
Column of Water Drops with Seafloor
Column of Water Rises with Seafoor
Oceanic Plate Drops
Oceanic Plate Rises

PHASE I

TSUNAMI HITS THE SEA SHORE



PHASE II

URBAN FIRES

Introduction:

Urban fires describe an uncontrolled burning fire like wildfires usually in towns, cities and wild land which can cause damage to forestry, agriculture, infrastructure and buildings.

Causes of Urban Fires:

Urban fires can become by accident, maliciously or as the result of an unseen ignition for example by an electrical, mechanical or chemical process. Fires may also result of a natural cause such as an earthquake or lightning. Most of the fires occur in the kitchen due to cooking carelessness and often rubbish fires are left unattended, spreading to vegetation and ultimately to property. While living in a city it may not increase the risk of fire, demographic changes include the growing number of older adults, people with disabilities, immigrants and people living in poverty much impact fire safety in the city. Many a times factories located in the suburban area catch fire because of mismanagement or leakage of fuels and result in loss of property and human lives. Short circuiting of electrical wires in the buildings and skyscrapers continues to remain a threat for dangerous fires.

Remedial Measures:

Early intervention is critical in all fires, most start small but escalate in minutes, events caught early with appropriate responses will be easier to control or contain. The installation of home sprinklers will protect the family and the home from the dangers of fires. Quality fire fighting instruments are absolutely necessary for the protection of factories from fires. An emerging help should be sought from the rescue service by calling them and supplying them with the exact location. Fire restrictions should be seriously noted around places like petrol pumps. Fire hydrants play an important role in case of emergency by supplying water to the effected cities. Fire exits should be clearly displayed in hospitals, cinema houses and big plazas including hotels.

VOLCANOES

Introduction:

A volcano is where magma erupts. Magma is the molten super hot material present inside or beneath a volcano. At the time of volcanic gas, the lava can explode if the gas bursts out, hurling blocks of rock out of the crater and the clouds of fragments bill out or flow away. Lava comes out of the crater and from cracks in the volcano and it flows downhill, following valleys, spreading out as it reaches flat land.

A simple cross section of a volcano

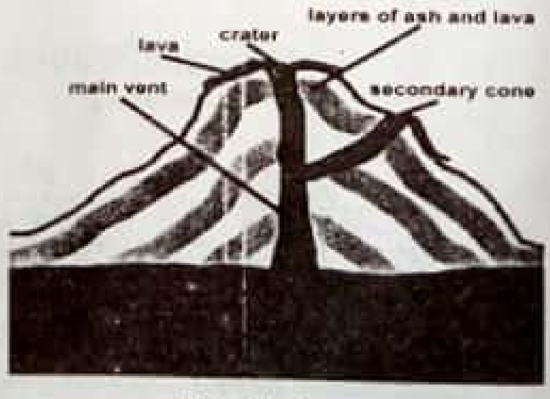


Fig. Volcano

Types of Volcanoes:

Viscosity or stickiness of magma determines the type and the frequency of volcanic eruptions. Volcanoes with runny magma of low viscosity tend to erupt more often, and with smaller explosions. Volcanoes with sticky, pasty magma erupt frequently but with enormous explosive energy. Viscous or pasty magma mainly contains silica. Most of the volcanic eruptions can be steam-assisted because volcanoes erupt through water. Gas is an important component of magma and it largely consists of steam and carbon dioxide. The temperature of the runny magma can reach upto 1200°C. A large amount of ash is also given out during the volcanic eruption. Ash consists of pulverised rock and lava.

Classification:

Volcanoes can be classified as Active, Dormant or Extinct. A volcano is considered active if it has erupted within the last few hundred years, dormant if it has erupted within the last several thousand years and extinct if it has not erupted within the last ten thousand years or more.

Common Places of Volcanic Activity:

There are about 1300 potentially active volcanoes in the world. Common places of active volcanoes are Hawaii, Philippine, Indonesia, Mexico, Java, New Zealand, Japan and Iceland. The volcanoes of Hawaii are probably the most thoroughly studied in the world.

Cause and Prediction of Volcanoes:

Scientists have learned that the Earth is slowly cooling as heat escapes from the deep interior to the surface. Spreading ridges are the Earth's greatest volcanic mountain chains, and from where the surface is splitting apart. Predicting the behaviour of most volcanoes is difficult because decades or centuries may pass between eruptions, and the buildup to an eruption may take place in only days or months.

Volcanoes as Windows into the Earth:

Volcanoes are our most direct link to the inside of the Earth. They are a source for samples of material that normally lie deep beneath our feet, and they give us a feeling for the degree of restlessness inside the Earth. More than 8 percent of Earth's surface has been formed by volcanic activity of one kind or another. Volcanism is a major process in the evolution of rocky planets and moons.

NOTABLE VOLCANIC ERUPTIONS OF THE 20TH AND 21ST CENTURY

1.	1902	Soufriers, St. Vincent
2.	1902	Mount Pelee, Martinique
3.	1902	Santa Maria, Guatemala
4.	1907	Ksudach, Kamchatka, Russia
5.	1911	Taal, Luzon, Philippines
6.	1912	Katmai/Novarupta, Alaska
7.	1914	Lassen Peak, California
8.	1919	Kelut, Java, Indonesia
9.	1930	Merapi, Java, Indonesia
10.	1932	Quizapu, Chile
11.	1943	Paricutin, Mexico

12.	1951	Lamington, Papua New Guinea
13.	1956	Bezymyannaya, Kamchatka, Russia
14.	1963	Surtsey, Iceland
15.	1963	Agung, Bali, Indonesia
16.	1980	Mount St. Helens, Washington
17.	1982	EL Chichon, Mexico
18.	1985	Nevado del Ruiz, Colombia
19.	1991	Pinatubo, Luzon, Philippines
20.	1991	Cerro Hudson, Chile.
21.	1993	Northern Chile
22.	1994	New Britain
23.	2002	Songhie Island (Indonesia)
24.	2005	Northeast of New Guinea
25.	2006	New Britain
26.	2008	Aleutain Islands
27.	2008	Aleutain Islands
28.	2009	KURIL Islands

EARTHQUAKES

Introduction:

The Earth's Lithosphere is divided into 15 major Tectonic Plates of various sizes. These plates float on the partially molten Asthenosphere below, and it is because they are floating that they have the freedom to move horizontally. The theory of plate tectonics assumes that each plate behaves as a rigid unit, deforming only at as its edges. The edges, or margins can diverse, converge or slide past one another. But, there is a very little change in the middle of a plate. Actually, some of the Earth's most dynamic features, such as volcanoes and Earthquakes, define the boundaries of the main plates.

Cause of an Earthquake:

The plate boundaries are the most technically active parts of the Earth — they are where most mountain building, Earthquakes and volcanoes occur. An Earthquake occurs when the edges of two plates suddenly slide past each other along a fault line. The severity of an Earthquake is measured on the **Richter scale;** it is logarithmic, so each additional point represents a tenfold increase in severity. The key to plate tectonic is that the surface of the Earth exists in a state of equilibrium and it provides a global framework that successfully explains many of the structural and geophysical phenomenons on the Earth's surface ranging from mountain building and Earthquakes to continental drift. Even though the mechanics of Earthquakes are understood, accurate prediction of their occurrence has remained beyond reach.

MAJOR TECTONIC PLATES OF THE CRUST OF THE EARTH

1. African
2. Antarctic
3. Arabian
4. Australian
5. Caribbean
6. Cocos
7. Eurasian
8. Indian
9. Jun de Fuca
10. Nazca
11. North American
12. Pacific
13. Philippine
14. Scotia
15. Somali
16. South American

Damage caused by Earthquakes:

The damage caused by earthquakes is normally divided into following types:

Primary Effects: Primary effects happen immediately and are due to the shaking of the ground.

Secondary Effects: Secondary effects happen afterwards and are as a result of the damage done by the initial tremors.

NOTABLE EARTHQUAKES OF THE 20TH AND 21ST CENTURY

Sr. No.	Year	Countries Hit	Severity on Richter Scale	Deaths
1.	1906	San Francisco, California	7.7	3,000
2.	1908	Messina, Italy	7.0	110,000
3.	1920	Gansu and Shaanxi, China	8.3	200,000
4.	1923	Tokyo, Japan	7.9	142,810
5.	1927	Qinghai, China	7.7	200,000
6.	1935	Quetta, Pakistan	8.1	30,000
7.	1939	Erzincan, Turkey	7.6	32,700
8.	1948	Fukui, Japan	6.9	5,390
9.	1960	Southern Chile	9.5	5,700
10.	1964	Southern Alaska	9.2	131
11.	1970	Northern Peru	7.9	67,000
12.	1971	San Fernando California	6.7	58
13.	1976	Mindanao, Philippines	7.6	8,000
14.	1976	Guatemala	7.6	22,780
15.	1976	Tangshan, China	7.4	655,000
16.	1980	EL Asnam, Algeria	7.1	2,590
17.	1985	Michoacan, Mexico	8.1	9,500

18.	1988	Armenia	6.8	25,000
19.	1989	Loma Prieta, California	7.0	62
20.	1990	Western Iran	7.5	50,000
21.	1992	Landers, California	7.3	1
22.	1993	Latur, India	6.2	9,750
23.	1994	Northridge, California	6.7	60
24.	1994	Northern Bolivia	8.3	10
25.	1994	Kuril Islands, Japan	8.3	10
26.	1995	Kobe, Japan	6.9	5,200
26.	2001	India, Pakistan, America, Mexico.	8.1	Several thousands
27.	2003	Iran	6.6	31,000
28.	2004	Indonesia	9.1	2,30,000
29.	2005	Pakistan	7.6	79,000
30.	2008	China	7.9	69.197
31.	2010	Haiti	7.0	2,30,000

EARTHQUAKE BY NUMBER

Magnitude	Description	Occurrences per year (unless otherwise noted)
1.0 – 1.9	Extremely minor	About 8,000 per day
2.0 – 2.9	Very minor	About 1,000 per day
3.0 – 3.9	Minor	Approximately 49,000
4.0 – 4.9	Light	Approximately 6,200
5.0 – 5.9	Moderate	800
6.0 – 6.9	Strong	120
7.0 – 7.9	Major	18
8.0 and higher	Great	1

ENERGY RESOURCES

INTRODUCTION

Energy is one of the fundamental ideas in Physics. It is the name given to the ability to do work. Energy is needed to do all types of work — you even need energy to throw a ball into the air and catch it. Work and Energy are measured in the same units. When an object continues to stay at rest or to keep moving, we call this Inertia. People often confuse Energy, Power and Force. Force is a push or pull on an object or body. If you want to start or stop something moving, you need to push or pull it. These pushes and pulls are called Forces.

Forces are needed to overcome, or beat, inertia. Forces are produced by energy change. The amount of work is determined by the strength of the force used and the distance through which it moves. Power measures the rate at which work is done.

Units of Energy:

There are various units for the measurement of energy. In the metric system, energy is measured in Joules. Other popular units are Erg, Foot-pound, Electron Volt, Calorie and Btu. Calorie is the unit of heat energy and is defined as the amount of heat required to raise the temperature of one gram of water through 1°C. It is more commonly used in biological sciences.

Inter-convertible Forms of Energy:

Energy and Mass are locked in the Einstein's Famous equation: **$E = mc^2$**, where E is the energy, 'm' is the mass and 'c' is the velocity of light. This equation shows that mass and energy are inter-convertible but the conversion of a very small mass will give a very large amount of energy. Energy can be considered a concentrated form of matter, and matter a concentrated form of energy. Energy can neither be created nor destroyed but it can change into different inter-convertible forms under different conditions. More popular forms of energy are Potential, Kinetic, Heat, Solar, Electrical, Mechanical, Tidal, Wind, Geothermal and Nuclear.

ENERGY CONVERSION CHART

SCIENTIFIC DEVICE PHENOMENA	NATURE OF ENERGY CONVERSION
Electronic Cells	Chemical to Electrical
Photoelectric Effect, Radio Aerial	Radiation to Electrical
Thermocouple, Thermoelectric Effect	Thermal to Electrical
Generators, Piezo-Electric Effect	Mechanical to Electrical
Emission of β-particles	Nuclear to Electrical
Photosynthesis	Radiation to Chemical
Endothermic Reaction	Thermal to Chemical
Radio Waves	Electrical to Radiation (light)
Chemiluminescence*	Chemical to Radiation (light)
Phosphorescence**	Kinetic to Radiation (light)
Resistance Heating	Electrical to Thermal
Motors	Electrical to Mechanical
Exothermic Reaction	Chemical to Thermal
Friction	Mechanical to Thermal
Nuclear Fission	Nuclear to Thermal
Muscular	Chemical to Mechanical
Misc.	Sound to Electrical
Speaker	Electrical to Sound.

The emission of light during a chemical reaction, e.g. the oxidation of yellow phosphorous. The light emitted by the fire fly or glow warm and luminous combustion are examples of this very common phenomenon.

- A form of luminescence in which a substance emits light of one wavelength after having absorbed electromagnetic radiation of a shorter wavelength. Unlike fluorescence, phosphorescence may continue for a considerable time after excitation.

Renewable Energy Sources:

Renewable energy sources are those which will replenish themselves naturally in a relatively short time and will therefore always be available. Examples are geothermal, solar, tidal, wind and hydro-electric.

Non-Renewable Energy Sources:

Non-renewable energy sources are those which cannot be used again and again. Typical examples are Fossil Fuels.

Sources of Energy:

All the movement on the surface of the Earth requires energy. The ultimate source of all kinds of energy comes from the Sun. Sun provides the energy needed to produce the food. A car moves by the energy supplied by petrol and petrol comes from oil, which provides the energy for most of the world's transport. Sources of Energy can be divided into two main classes:

Primary Sources and Secondary Sources:

Electricity is the most common and popular form of energy which is actually itself made from energy released by burning coal or oil or by using nuclear fuel or water power. Each of these four sources of energy is called a primary source. Electricity is a secondary source, because it is produced from a primary source. Some major and minor sources of energy can be grouped as under.

1 Calorie = 4.186 Joules		
1 Btu (British thermal unit) = 252 Calories = 778.26 Foot-pound		
No.	**Energy Source**	**Major or Minor**
1.	Fossil Fuels	Major
2.	Hydel Power	Major
3.	Nuclear Energy	Major
4.	Wind Power	Minor
5.	Tidal Energy	Minor
6.	Solar Energy	Minor
7.	Geothermal Power	Minor

FOSSIL FUELS

The power of sunlight captured millions of years ago by plants and animals that died and buried in huge deposits is now being burned as Coal, Petroleum and Natural Gas, these are called fossil fuels. The Earth has only limited supply of fossil fuels. The amount used has now been almost doubled because of the high demand of energy. Scientists are seeking new sources of energy to replace shrinking fossil fuels. Fossil fuels consist of the following major materials.

[redacted]

1. COAL:

Over millions of years, layers of rotting plants were pressed more and more tightly together. Peat, lignite and eventually coal were formed. Anthracite, the oldest and hardest coal, is 400 million years old. It provides about 30% of all the energy used in the world. It can be used for the production of electricity and steel

Energy Profile for Pakistan

Year	Production of Electricity in Pakistan
1947	Coal 59%, Hydro 3%, Oil 38%
1987	Coal 9%, Hydro 13%, Oil 40%, Gas 48%
2009	Oil 29.4%, Gas 50%, Coal 7.6%, Hydro 11.4% Nuclear 1.2%, LPG 0.4%

2. PETROLEUM:

BLACK GOLD OR LIQUID GOLD

The word petroleum literally means rock oil. It is a thick dark oily liquid containing a mixture of hundreds of organic compounds (hydrocarbons). Petroleum furnishes almost half of the energy used in the world. Oil was formed in a similar way to coal plants and animals that lived in the seas sank down the sea-bed when they died. They were further crushed under layer of mud, and gradually turned into oil. The oil then followed upwards until it reached layers of hard rocks and became trapped under the rocks.

Major Oil producing Countries:

Crude oil production continues to remain as one of the major industries of any country Ex-USSR, U.S.A., Venezuela, Kuwait, Algeria, Iran and Saudi Arabia are regarded as the pillars of Petroleum Club, The major oil-producing nations of the Middle East—Saudi Arabia, Kuwait, Iran, Iraq, Qatar and the United Arab Emirates— ring the Persian Gulf and naturally assume the shape of a drop of oil in the world map.

The price of crude oil per barrel crossed $ 150, for the first time in history in 2007-08. The impact of this unprecedented price hike on Pakistan and other countries and particularly those of the third world is appalling. Pakistan today produces only 30 percent of its oil requirements.

GLOBAL SEARCH FOR CRUDE OIL

A worldwide scramble to find out new oil fields continues. Modern technology has made it a little easier. Three dimensions seismography allows geologists to get a more precise, detailed picture of the folds and ripples in the Earth's crust and pinpoint rock formations that can yield crude oil. In 1990, geologists added nearly 100 billion barrels to the world's proven oil reserves to more than one trillion barrels. Alaska and Siberia are the places included in the hit list of the geologists for crude oil deposits. Siberia may prove another Middle East in future.

PETROLEUM PRODUCTS:

Petroleum is a complete liquid mixture of a variety of organic compounds. The chief components are hydrocarbons, which may be aliphatic, alicyclic, or aromatic in varying proportions. In addition to carbon and hydrogen petroleum contains 1 to 6% of sulphur, nitrogen and oxygen present as organic compounds.

Crude petroleum is the starting material not only for the fuels used for transportation and energy production but also for petrochemicals, feedstocks, solvents, lubricants, asphalts and many other specialities like kerosene oil and petrol. It is however, not easy to do the separation of the individual components from the crude petroleum which is done at an Oil-refinery. Therefore, petroleum is first refined, that is separated into useful products, by distillation into fractions of different boiling ranges, conversion of the less desirable components into more valuable product, and treatment of fractions in various ways to remove undesirable components.

LPG:

The liquefied petroleum gases (LPG), methane, ethane, propone and butanes, are used chiefly as fuel.

Solvents:

The petroleum ethers, ligroins, naphthas, and mineral point spirits boil from 30 to 140 °C and are used as solvents.

Gasoline:

It is the fraction boiling between 0°C to 200°C.

Transport Oils:

Other commercial fractions of petroleum are kerosene oil, turbine fuel, and jet fuel (b.p. 175°C-275°C), gas fuel, fuel oil and diesel oil (b.p. 250°-400°C), and lubricating oil. A desirable characteristic of diesel fuel is a low spontaneous ignition temperature.

Paraffin:

It is the mixture of solid saturated hydrocarbons that crystallizes from various high boiling fractions.

Greases:

Greases are made by dispersing metallic soaps in hot lubricating oils.

Pitch and Asphalt:

Pitch and asphalt are residual products used as protective coatings and as binding agents for fibre and crushed rock. If these residues are distilled to dryness, Petroleum coke is obtained, which can be claimed to a practically pure carbon that is valuable for the manufacture of carbon electrodes.

3. NATURAL GAS:

As the oil is formed under the bed of the Earth's surface by the biodegradation of plants and animals, it also gives off a large amount of natural gas. This is also the chief source of hydrocarbons. Natural gas varies greatly in composition. Unprocessed gases contain 60-80% methane, 5 to 9% ethane, 3-18% propane and 2-14% higher hydrocarbons. Most of the natural gas is used for fuel. Although an increasing amount is being used as raw material for the synthesis of large number of important organic compounds. Natural gas is also used for the production of electricity.

Natural gas is the cheapest and most efficient source of energy in Pakistan and the first field was discovered at Sui in 1952. The natural gas of Pakistan has high methane content, usually 70-90 percent. It is being used by industry, for power generation and for domestic purposes. Its production was 10 thousand million cubic metres in 1982-83 and is increasing by finding more gas-rich places. Natural gas is playing a vital role in the economic development of Pakistan by providing a cheap fuel for industry.

HYDEL POWER OR HYDRO-ELECTRIC POWER

Electricity can also be produced at a power station without burning coal or oil. This is done with the help of building dams at elevated areas where there is plenty of rainfall. A large dam built across a river stores a huge amount of water as a lake. The power station can turn the potential energy of water into kinetic energy, and then convert this energy into electrical energy by using a generator.

Shortage of energy is the most serious handicap restricting Pakistan's development programmes. In 1987-88 the total primary energy consumption in Pakistan was around 36 million tons of oil equivalent (MTOE) of this, about two-third was met from commercial energy resources. This was largely based on the use of non-renewable sources of energy mainly hydrocarbons. Despite the transformation in the energy profile since the birth of the country in 1947 the hydro contribution which is a renewable source of energy is still only 13%. Tarbela and Mangla dams alone are unable to meet the requirement of the country. The demand for electricity is growing rapidly and is outstripping the rate at which new generating capacity can be introduced. At present the total installed generation capacity is about 20000 MW.

Kalabagh Dam project can generate 3600 MW when completed. The project is located on river Indus, 100 miles MAF storage capacity on final completion, if Kalabagh Dam falls a prey to politics, chances of hydel power generation will be doomed.

SOLAR ENERGY

The Sun is a huge source of energy. The amount of energy reaching the Earth from the Sun could be more than produced by million of power stations. A large amount of heat can be produced by using mirrors to direct and concentrate the solar radiations. A solar furnace in Southern France collects enough of the Sun's energy to melt metals. Flat-plate collectors are used to heat buildings and water. Sunlight can also be converted into electricity by solar cells or photovoltaic cells. Each cell is made of layers of a material that produces electrical energy when light shines on it. Many watches and calculators are powered by solar cells. Large solar cells are used to provide electrical energy in places that are far away from normal electricity supplies. Solar cells provide nearly all the electric power for artificial satellite and space vehicles. Cars and even light aircraft can be powered by solar energy. Radio telephone in Saudi Arabia is powered by solar energy.

NUCLEAR ENERGY

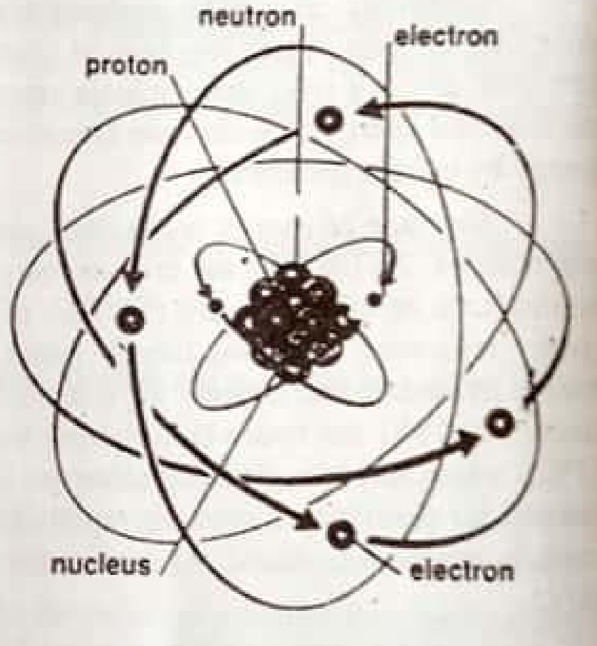
FRIEND OR A FOE

Introduction:

Nuclear energy is the most powerful form of energy in the Universe. Only this form of energy can meet the demands of more than 6 billion people living on the Earth. About 30 nations use nuclear energy to generate 1/6th world's electricity. There are about 530 nuclear power reactors in operation and another 96 are under construction in the world. There are two ways of producing nuclear energy and both ways release an enormous amount of heat. One way is to split the nucleus of an atom. This process is called Nuclear Fission. The other way is to join together or fuse the nuclei of two atoms at a very high temperature. This process is called Nuclear Fusion and this is the basis of source of energy in the Sun.

NUCLEAR FISSION

At present, nuclear energy commonly refers to energy production by nuclear fission because this is currently the only commercially feasible method. Chemical energy is locked up inside atoms and molecules. An atom is made up of three different kinds of particles — protons, neutrons and electrons. The protons and neutrons are crowded into the nucleus near the centre of the atom. The electrons go round and round the nucleus along precise pathways. The nucleus is the small and dense central core of the atom. It is constructed of a tightly packed array of positively charged protons and neutral or uncharged neutrons neutrons. The nucleus is held together by nuclear forces, which differed from such other forces as gravity or electromagnetic force in their strength and in their dependence on the arrangement of particles.



To divide a nucleus into two parts requires the injection of energy, for example, by bombardment of the nucleus with another particle under proper conditions this bombardment will initiate an energy-producing chain reaction. In the fission process, heavy nuclei, such as those of Uranium, are bombarded with neutrons and split into two particles of mass in the ratio of roughly 3 to 2. The resulting fission fragments have less mass than the original nucleus, with the excess mass appearing as energy about 200 MeV per fission. Most of this kinetic energy is converted into heat that is used to generate steam in a power plant.

Energy Units for Nuclear Power:

The amount of energy is often expressed in a unit known as the electron volt (eV). It is defined as the amount of energy imparted to an electron by accelerating it through a potential difference of one volt. One electron volt is a small amount of energy, it takes 2.25 × 10^{25} eV to give 1 Kilowatt hour (KWH), which is equivalent to the energy per hour of ten 10-watt light bulbs.

Typical Nuclear Fission Reaction:

A typical nuclear fission reaction involves the combination of one neutron with Uranium — 235 to yield isotopes of Krypton and Barium, 2 neutrons, and energy.

$$^{235}_{92}U \quad {}^{1}_{o}n \rightarrow {}^{90}_{36}Kr + {}^{44}_{56}Ba + {}^{1}_{o}2N + E$$

Fig.

The subscripts represent the number of protons and the superscripts the total number of proton and neutrons. Natural sample of Uranium contains 0.7% U^{235} and 99.3% U^{238}. Uranium — 235 is more useful nuclear fuel.

THE NUCLEAR REACTOR OR THE NUCLEAR POWER PLANT

The nuclear reactor is the device in which the fission reaction involving neutrons and nuclear fuel is controlled for the production of heat energy. This heat energy is eventually converted by means of Turbines and Generator to electrical energy for commercial use. A nuclear power plant works in a similar way to an oil-fired or coal fired power station. The difference between the two types of power plants is in the fuel they use to heat the boilers. Inside a nuclear power plant, energy is released by nuclear fission in the core of a piece of equipment called the reactor. The energy heats water in. the boiler — the water boils and produces steam. This steam turns the huge turbine wheels, and the turbines drive the generator that produces the electricity.

Parts of a Reactor:

The principal components of a reactor are:

(i) The fuel, which may range from natural uranium, slightly enriched uranium (3%), to highly enriched uranium. Most of the commercial reactors are powered by fuel containing 1.6 to 5.5% Uranium —235.

(ii) A moderator in the form of ordinary water. Heavy water, graphite, beryllium or beryllium oxide to slow down the neutrons produced during fission so that they can be captured by fuel nuclei.

(iii) A coolant, in the form of water, heavy water, helium gas, carbon dioxide or liquid sodium, to extract fission heat for useful purposes.

Types of Reactor:

Various types of nuclear reactors are:

LWR : Light Water Reactor
BWR : Boiling Water Reactor
PWR : Pressurised Water Reactor
HWR : Heavy Water Reactor

HTGR : High Temperature Gas Cooled Reactor

HEAVY WATER

A Layman's Guide

Heavy water is a naturally occurring substance, it occurs in "ordinary" water in the proportion of approximately one part heavy water to 7,000 parts of ordinary or light water.

Hydrogen and oxygen combine to form water (H_2O). Heavy water is a similar combination of deuterium and oxygen (D_2O). Hydrogen exists in three forms (or isotopes) which could be called Hydrogen 1, 2 and 3 but instead have three individual names. Hydrogen 2, which differs from hydrogen 1 by having a neutron in its atomic nucleus, is called deuterium. Hydrogen 3, which has two neutrons in its nucleus, is called tritium. This is a radioactive substance and does not occur in the nature to any real extent.

Deuterium was discovered by the American chemist, H.C. Urey and co-workers in the early 1930s. The extra neutron makes the deuterium atom heavier than the hydrogen atom, hence the term for deuterium oxide, heavy water. In practical terms, heavy water weighs about 10 percent more than ordinary water, heavy water and ordinary water also have different freezing and boiling points. However they look the same and taste the same and in general their properties are so similar that separation of two is a difficult task.

Heavy water is used as a "moderator" in Canadian Nuclear Power Reactors. The moderator slows, or "moderates", the speed of the neutrons released during fission of Uranium-235 atoms so that the incidence of fission is increased. The neutrons maintain a self-perpetuating chain reaction, producing continuous heat to operate steam turbines and generate electricity.

Moderating materials that can be used in nuclear reactors include ordinary water, heavy water, graphite and beryllium. A good moderator should be relatively stable and a poor neutron absorber. To compare the efficiency of materials used as moderators, a "moderating ratio" is used. The moderating ratio of ordinary water is 60, of beryllium is 150, of graphite is 220, and that of heavy water is 1700.

It is the use of this most efficient of moderating material that distinguishes the Heavy Water Reactor system and offers a number of important advantages. One is the use of natural uranium fuel as opposed to the enriched fuel that has to be used in other major nuclear power system. The cost of fuelling a HW reactor is much lower than that for any other type of commercial reactor. For the same unit of power produced, a HW reactor requires only about half as much uranium as a reactor that burns enriched fuel.

All naturally occurring compounds of hydrogen also contain some deuterium and there are a number of ways in which the deuterium can be extracted. However, the only process that has been used on a large scale is based on the exchange of deuterium between water and hydrogen sulphide at different temperature.

	FREEZING POINT		BOILING POINT	
ORDINARY WATER	32°F	0°C	212°F	100°C
HEAVY WATER	39°F	3.82°F	214.6°F	101.42°C

This process is based on the fact that deuterium migrates to the water steam at low temperatures and to the hydrogen sulphide gas at high temperatures. By a suitable arrangement of flow in separating towers, deuterium can he extracted from feed of ordinary water. In each tower the water flows down through a series of perforated plates or trays, while the hydrogen sulphide bubbles up through the trays. This promotes efficient mixing. This process is then repeated in the second stage and in a further stage. Enriched water from the third stage then passes to a finishing section where it is distilled to a reactor grade products that is 99.75 percent pure D_20.

NUCLEAR SAFETY

Nuclear or Radioactive Waste:

Nuclear reactors release another kind of energy called Radioactivity. Radioactivity is accompanied by the emission of powerful radiations which if escape into the atmosphere, can cause serious damage to humans, animals and plants. It is due to this reason that a nuclear reactor is sealed inside a shield of reinforced concrete. Radiation comes in three varieties: Alpha particles, Beta particles and Gamma Rays, Alpha particles are compact clusters of two protons and two neutrons that carry away the excess energy. They are, in fact, nuclei of helium. The β-particles are fast moving electrons and gamma rays are electromagnetic radiation akin to light but with very short wavelengths and very high energy. It is the radiation that radioactive substances emit that has the potential to be harmful.

Nuclear reactors produce million of tons of nuclear wastes. Nuclear wastes are the radioactive byproducts of the fission process. The proper disposal of the nuclear waste continues to remain a global challenge. No country currently has a permanent repository for such materials and the waste, therefore, keeps piling up. Several methods of waste disposal have been considered, including sealing wastes in concrete vessels to be dumped in the oceans, irradiating them with neutrons to transmute isotopes into harmless, launching them into space by means of rockets, or allowing them to melt their way through Antarctic ice to rest on the bedrock. None of these has as yet been put into practice, and all have drawbacks of one form or another.

Decommissioning Nuclear Plants:

A nuclear power plant cannot run forever producing nuclear energy but they generally have a life of 30 to 40 years after they started. Decommissioning is a fancy word for disposing of nuclear reactors that are too old to run safely or economically. Some 50 nuclear power plants in western nations are waiting to be decommissioned in the next decade. Karachi nuclear power plant in Pakistan will also have to be decommissioned soon while a new one is being built near Chashma.

NUCLEAR CONTRIBUTION AND ENERGY PRODUCTION IN DIFFERENT COUNTRIES

COUNTRY	ENERGY PRODUCTION	NUCLEAR CONTRIBUTION
France	425 TWh	74.6%
Japan	1.025 trillion watt hour	27%
U.K.	40 Giga Watt	21.7%
U.S.A.	783 Giga Watt	19.1%

China	875 Giga Watt	6%
Russia	137 Giga Watt	16%

Nuclear Capacity of Different Countries:

France is rated as number one in the nuclear capacity as it produces about 75% of its electricity from the nuclear power plants. A comparative chart is given below:

NUCLEAR FUSION

Nuclear fusion is another way to get energy. Man has always copied nature and now he wants to duplicate the nuclear process occurring in the Sun for the production of energy. The word 'fusion' means joining together. The energy emitted by the stars is believed to result form the fusion of hydrogen nuclei to form helium nuclei. Such reactions which occur at a very high temperature are termed as thermonuclear reactions. Fusion processes are spontaneous only at temperatures of the order of 10^{8°C or higher.

The conversion of hydrogen into helium takes place in stages. Two deuterium nuclei are fused to form Helium-3, starting with the deuterium molecule. The large amount of energy that is released results from the mass difference between two deuterium nuclei and the helium-3 nucleus and a neutron.

Although methods for controlling the nuclear fission reaction have been developed and used to produce useful power, similar control of nuclear fusion has not yet been realized. The principle problem is the confinement of fusible plasma at a temperature sufficiently high for fusion reaction to proceed (10^{8°C). A solution to the problem is currently being sought by using two distinct methods, magnetic confinement and laser induced fusion.

Dreams of nuclear fusion continue to attract the world top scientists the lure of cheap, unlimited and pollution free energy for the future, the success may lie fifty years ahead but once harnessed, the electricity produced would be too cheap to metre.

Energy Conservation:

It is a process in which electricity is used more efficiently to save energy. This can be done by a number of ways designing better buildings, manufacturing better electric bulbs, using air-conditioners sparingly and by changing the life style. Asia is in the midst of an electricity crisis brought on by booming growth and wildly extravagant use of energy. Virtually every country in the region is facing a potential capacity crunch Cheap, dependable electricity is vital for continued economic expansions yet the cost of new power stations is staggering. Even if, more power stations are built, without the promotion of more efficient use of electricity, would do no good. It requires almost a revolution in the conservation methodology.

A kilowatt-hour of electricity can light 100-watt lamp for 10 hours or lift a ton one thousand feet into the air or smelt enough aluminum for a six-pack of soda cans or heat water for a few minutes shower. But, by using electricity more efficiently, more mechanical work can be taken out from the same kilowatt-hour.

We can also save energy by recycling programmes. Our food wastes can be recycled into products such as animal feed, soil amendment materials, and even fuel for power plants.

RADIATIONS AND LIVING THINGS

How much is too much?

It is the radiation that radioactive substances emit that has the potential to be harmful. The degree of harm to people depends on how they are exposed to radioactive materials, whether for example they touch them or eat them as food, on the rate of radioactive decay in the material, and on the type of radiation. The main way that radiation loses energy in materials is through ionization. In biological tissue, ionization can lead to abnormal chemical reactions and molecular changes, which can destroy a cell or change how it functions. In particular, damage to the genetic material in a cell can lead to uncontrolled proliferation of the cell which may result in cancer, or in reproductive cells, ionization may give rise to hereditary disease in the children of the individual.

Measurement of Radiation Doses:

The damage caused to the human body by radiation depends upon the amount of the dose. Small doses can cause minor diseases while high doses of radiation cause gross destruction of tissue. There are many ways of measuring radiation. Exposure to radiation is measured in small units like 'rad' (Radiation Absorbed Dose) and 'rem', which is acronym for Roentgen Equivalent in Man. It is a measure of the biological damage produced by a particular dose of radiation.

It is interesting to mention that a patient receives about one-fiftieth of a rem during a typical X-ray exposure.

Damage Caused to the Human Body When Exposed to Radiation:

AMOUNT OF RADIATION DOSES	DAMAGE CAUSED
0.100 rems	Nausea, Vomiting — not fatal
100-200 rems	Modestly depressed White-cell count. Not immediately fatal, long-term risk of cancer.
200-600 rems	Heavily depressed White-cell count, blotched skin and chances of death.
600-1000 rems	Heavily depressed white-cell count blotched skin and acute bowl syndrome in 4 to 6 weeks, 80-100% chance of death.
1000-5000 rems	Diarrhea, fewer, blood-chemical imbalance in 1 to 14 days. Virtually 100% chance of death.

Detection of Radiation:

Generally, we cannot see, hear, feel, taste or smell radiation. Then how do we know that it is there? This is done with Geiger counters. These are instruments that extend our senses so that we can see or hear the effects of radiation.

READY RECKONER FOR POWER GENERATION AND CONSUMPTION IN PAKISTAN

Installed Capacity	22797 MW
Average Demand	17000 MW
Shortfall	4000 - 5000 MW

TYPES

KINDS	PRODUCTION	PERCENTAGES
Fossil Fuels	14635 MW	64.2 %
Hydroelectric	6611 MW	29 %
Nuclear	1322 MW	5.8 %
Others	229 MW	1.0 %

ENERGY TERMS

Barrel:

It is a unit of crude petroleum, equal to 42 US gallons or about 306 pounds.

One U.S. Gallon = 4.456 Litres
One U.K. Gallon = 3.785 Litres

BTU (British thermal unit):

The amount of heat necessary to raise the temperature of one pound of water through one degree Fahrenheit.

Barrel of Oil Equivalent:

Energy equal to a barrel of crude oil 5.8 million Burs.

Bio mass:

Living matter, plant and animal, in any form.

Biogas:

Gas given off by decaying dead animals or plants.

Efficiency:

The ratio of useful work or energy output to total work on energy input.

Megawatt:

A unit of power equal to 1000 kilowatts, or one million watts. A gigawatt is a billion watts.

Quad of Energy:

A quadrillion BTUs. The energy contained in eight billion gallons of gasoline, a year's supply for ten million automobiles.

Reserve:

That portion of a resource that has been actually discovered but not yet exploited and which at present is technically and economically extractable.

Gasohol:

A mixture of 90 percent unleaded gasoline and 10 percent ethyl alcohol.

Synfuels:

(Synthetic Fuels): Fuels synthesised from sources other than crude oil or natural gas and are used in place of them or their derivatives, primarily for transportation and heating boiler. Gasohol is synfuel.

Electromagnetic Energy:

Electromagnetic energy is made of vibration of electric and magnetic fields.

Acre-Foot:

It is a unit of volume and is used to measure irrigation water, runoff volume, and reservoir capacity One Acre ft = 1.233×10^3 m^3.

Kilowatt Hour (kWh):

It is bigger unit of energy used in addition to SI unit. One kWh = 3.6×10^6 Joules.

COMMONLY USED SCIENTIFIC UNITS

Name of Unit	Used for	Definition
Acre foot	Volume	An acre foot contains exactly 43560 cubic feet
Aeon	Time	It is equal to one billion years.
AFUE	Efficiency of a gas furnace	It represents the percentage of the fuel energy actually delivered as heat energy
Amber	Volume	The amber was equal to about 140 liters.
Ampere	Electric current	The amount of current is one ampere when resistance of the conductor is one ohm and one volt potential difference is applied across its end.
Angstrom(A)	Length	Equal to 0.1 nanometer or 10^{-10} meter
Arroba @	Weight	It is equal to 1/4 quintal
Barrel (bbl)	Volume	A barrel of petroleum equals 42 U
Bell	Time	One bell equals 1/2 hour or 30 minutes.
Baud (Bd)	Rate of data transmission	It is number of times per second; the signal carrying the communication varies in strength or frequency
Bacquerel (Bq)	Radioactivity	One Becquerel is the radiation caused by one disintegration per second
Bohr	Distance	The Bohr radius represents the mean distance between the proton and the electron in an unexcited hydrogen atom
Coulomb (C)	Electric charge	One coulomb is the amount of charge accumulated, in one second by a current of one ampere.
Cusec	Flow	Equal to 1 cubic foot per second
Dalton (Da)	Mass	An alternate name for the unified atomic mass unit (u or amu). The Dalton is often used in microbiology and biochemistry to state the masses of large organic molecules.
Darwin	Rate of evolution	If the measurement of a characteristic changes from a to b in v million years, then the rate of evolution is (In b - In a)/y Darwins.
Debye (D)	Dipole moment	The debye is defined as ah electric dipole moment of 3.33564×10^{-30} coulomb meter.
Diopter (dpt)	Refractive power of a lens	The distance from the center of the lens to the point at which the lens focuses light.
Dobson unit	Ozone in the	One Dobson unit represents the amount of

(DU) .	atmosphere	atmospheric ozone that would form a uniform layer 0.01 millimeter (10 micrometers) thick at standard temperature (0°C) and pressure it atmosphere).
Dyne (dyn)	Force	One dyne is the force that accelerates a mass of one gram at the rate of one centimeter per second per second.
Farad	Capacitance	The capacitance of the conductor is one farad if a charge of one coulomb, given to one of the parallel plates of a parallel plate capacitor, produces a potential difference of one volt between them.
Fermi (fm)	Distance	One Fermi equal 10^{-15} meter
Gilbert (Gi)	Magneto (Gi) motive force	It is equal to $\frac{10}{4pu}$ = 0.795/775 ampere-turns
Hertz (Hz)	Frequency	The rates of events that happen periodically in a fixed and definite cycle
Joule	Work	The work done by a force of one; Newton acting to move an object through a distance of one meter; in the direction of force.
Kelvin (K)	Temperature	The temperature in Kelvin is always equal to 273.15 plus the temperature in degrees Celsius.
Kilogram (kg)	Mass	The mass of the standard kilogram, a platinum-indium bar in the custody of the International Bureau of Weights and Measures (BIPM) near Paris, France.
Knot (kn)	Velocity	One knot equals about 0.5143 meters per second.
Lambda (λ)	Wavelength	The distance between two adjacent crests or troughs.
Lux (lx)	Illuminance	One lux equals 1 lumen per square meter.
Maxwell (Mx)	Magnetic flux	One Maxwell is the total flux across a surface of one square centimeter perpendicular to the field.
Meter	Length	One meter is the distance traveled by light in vacuum, during a time $\frac{1}{299,792,458}$ second.
Mho	Conductivity	Reciprocal of resistivity.
Newton	Force	The force is one Newton which produces the acceleration of one meter / second per second in the body of mass one kilogram.

NIT (nt)	Luminance	Candela per square meter.
Ohm(Q)	Resistance	One ohm is the resistance, reactance, or impedance that requires a potential difference of one volt per ampere of current.
Pascal (Pa)	Pressure	Equal to one Newton per square meter.
Pfund(pfd)	Weight	One pfund is equal about 1.2 pounds (560 grams).
Pieze (pz)	Pressure	The pieze is a pressure of 1000 Newton per square meter.
PHON (phon)	Loudness level	The pressure level in decibels of a per. 1,000 Hz. tone.
Quintal (q)	Mass	It is equal to 100 kilograms or approximately 20.4623 pounds:
Radian (rad)	Angle	3ne radian is the angle at the enter of a circle that cuts off an arc of length equal to the radius
Ream (rm)	Counting sheets of paper	A ream is equal to 500 sheets.
Red	Radiation	
Reyn	Dynamic viscosity	One Reyn equals 68.9457 kilopoise.
Richter scale	Earthquake intensity	A logarithmic scale measuring earthquake intensity
Rutherford (Rd)	Radioactivity	Equal to the mega Becquerel
Second	Time	A second is the duration in which the Cesium-133 atom completes 9,102631,770 vibrations.
Svedberg (S)	Sedimentation coefficients	Equal to 10^{-3} second.
Torr	Pressure	Equal to exactly $\frac{1}{760}$ atmosphere
VAR (var)	Reactive power	Port of entry of a single-phase two wire circuit.
Volt	Potential difference	The potential difference of one volt exist between two points if work done in moving a unit positive charge from one point to other, is one joule.
Watt	Power	The one-joule work is done in one second.
Wyde	Amount of data	Equal to 2 bytes.

DISASTER RISK MANAGEMENT

Introduction:

Natural disaster bring misery among the poor and vulnerable the most poor countries account for more than 70 percent of the world's disaster "hotspots". Since 1980 low income countries have accounted for only 9 percent of disaster events but 48 percent of the fatalities. The economic impact can be devastating for developing countries. An analysis report on Natural Hazards and Disasters funded by the World Bank Group, shows that disasters impact on Gross Domestic Product (GSP) is 20 times higher in developing countries than in the industrialized nations.

Impact of Disasters:

The impact of disasters will continue to rise with climate change exacerbating such trends. Flooding in Bosnia and Herzegovina in May 2014, for example set back the economy by about 15 percent of GPP. The Bank's Building Resilience Repot finds that over the last 30 years, natural disasters accounted for close to 4 US $ trillion in economic losses. Almost 75 percent of the losses are attributable to extreme weather events.

International Strategy:

Mainstreaming disaster risk management in development planning can reverse the current trend of rising disaster impact. Economic development, population growth and rapid urbanization are driving the rising trend in disaster losses. Urban areas are adding nearly 1.4 million inhabitants per week, with 90 percent of this growth taking place in Africa and Asia through 2050. If countries act wisely, they can save lives and assets. However, many developing countries lack the tools, expertise and instruments to factor the potential impacts of adverse natural events in their investment decisions.

Role of World Bank:

The World Bank has emerged as the Global Leader in disaster Risk Management (DRM) over the past 10 years and it is supporting the client countries to assess exposure to hazards and address disaster risks. It helps in the following areas:

(i) Technical and financial Support for Risk Assessment.
(ii) Risk Reduction
(iii) Preparedness
(iv) Financial Protection
(v) Resilient Recovery
(vi) Reconstruction.

The Bank's DRM portfolio has grown about 20 percent annually for the last five years. In providing support for DRM, the World Bank promotes a comprehensive, multi-sector approach to managing disaster risk.

Role of GFDRR in DRM:

GFDRR stands for the Global Facility for Disaster Reduction and Recovery which is a growing partnership of 41 countries and seven international organizations. It is actually the World Bank's institutional mechanism for DRM. A new World Bank – DFDRR DRM Hub in Tokyo was established in February 2014 under a $ 100 million DRM programme supported by Japan. The Hub will help to match relevant expertise with World Bank DRM operations and clients.

Major Initiatives taken by World Bank:

Over 100 million people in 50 countries gained improved access to risk information out of ir country through World Bank supported national and regional geospatial data sharing platforms since 2010.

1. **The Open Data for Resilience Initiatives (Open DRI):**

It is a key component of the World Bank's commitment to building disaster and climate resilience in some of the world's poorest regions. This initiative is currently active in more than 25 countries, mapping millions of buildings and urban infrastructure, opening more than 1,200 geospatial datasets to the public and developing innovative application tools. InaSAFEE is award winning, free open source software which produces realistic, natural hazard impact scenarios for better planning, preparedness and response.

2. **Catastrophe Deffered Drawdown Option (CAT – DDO)**

It is an innovative financing mechanism expanding the Caribbean catastrophe Risk Facility to Central America and a pilot facility in the pacific Islands.

3. **Metro Manila Flood Management Master Plan:**

The World Bank is providing cutting-edge country capacity building and technical assistance initiatives on disaster risk reduction and climate chance adaptation such as in the Philippines where such support led to the Government approved $ 9 billion Metro Manila Flood Management Master Plan.

4. **Post Disaster Needs Assessments (PDNAs):**

Since 2007, GFDRR – supported Post Disaster Needs Assessments leveraged about US $ 3.3 billion in disaster – specific medium- to long – term recovery and reconstruction investments.

5. **Knowledge Based Global DRM Publications:**

Publications informing the global DRM agenda with knowledge products include:

(i) Disaster Recovery Framework Guide.
(ii) Understanding Risk in an Evolving World.
(iii) Building Resilience
(iv) A Guide to Integrated Flood Risk Management.
(v) Climate Adaptation Profiles for 31 vulnerable countries.
(vi) Sendai Report.
(vii) Learning from Mega disasters.

PARTNERS:

The World Bank works closely with a variety of partners on disaster risk management and response, including UN agencies, regional bodies such as the African Union, other multilateral development banks, economic communities such as ECOWAS, Civic society organizations, technical agencies and the private sector. The partnership works to mainstream disaster risk reduction and climate change adaptation in country development strategies by supporting a country led and managed implementation of the Tioga Frameworks for Action.

Some of the special initiatives that reflect the range of partners that work with include:

[redacted]

(i) CAPRA Probabilistic Risk Assessment Initiative
(ii) Pilot Programme for Climate Resilience
(iii) Understanding Risk Network
(iv) Pacific Catastrophic Risk
(v) Open Data for Resilience Initiative
(vi) Asian Disaster Preparedness Centre
(vii) Code 4 Resilience.

MATTER

Everything around us on the earth, in the solar system or far off galaxies is made up of matter in an incredible variety of atoms. The whole universe is made up of matter or energy. All the different kinds of matter have one thing in common-mass. This is the amount of material in any object. Matter exists in three physical states namely, solids, liquids and gases. Simplest form of the matter is called an element. And an element is made up of atoms. Previously an atom was thought to be the individuals smallest part of an element. But over the years, the scientist have proved that even the smallest building block of an element, atom is completely divisible to a number of fundamental particles.

Structure of an ATOM:

More than 2400 years ago, Greek philosophers discussed the idea of atoms. The Greeks imagined what might happen if a material were cut repeatedly. Functually, the piece of material would be so small it could not be cut again and still have the properties of the material. The Greeks called the basic part of matter an atom, meaning "indivisible". As scientists discovered more elements, they pondered over the ultimate nature of matter. The ancient idea of atoms received a boost from English Chemist Thn Dalton (1766-1844) in 1808. He proposed that each element has its own unique atom, and that each compound is formed by a certain combination of atoms.

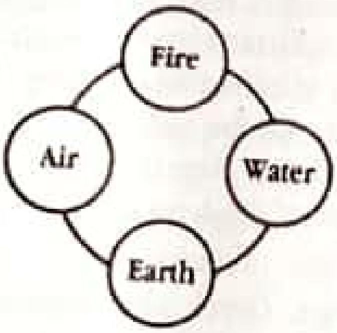
How big are Atoms?

Atoms, the basic building blocks of matter, are unimaginably small. More than a million atoms stacked on top of each other would barely be as thick as this sheet of paper. One way of envisioning the size of atoms is to imagine the relationship between a hydrogen atom, a golf ball, and the planet earth. A golf ball is as many times larger than an atom as earth is larger than the gold ball. Roughly, the size of hydrogen atom is 0.1nm or 10^{-10}m.

UNIVERSE

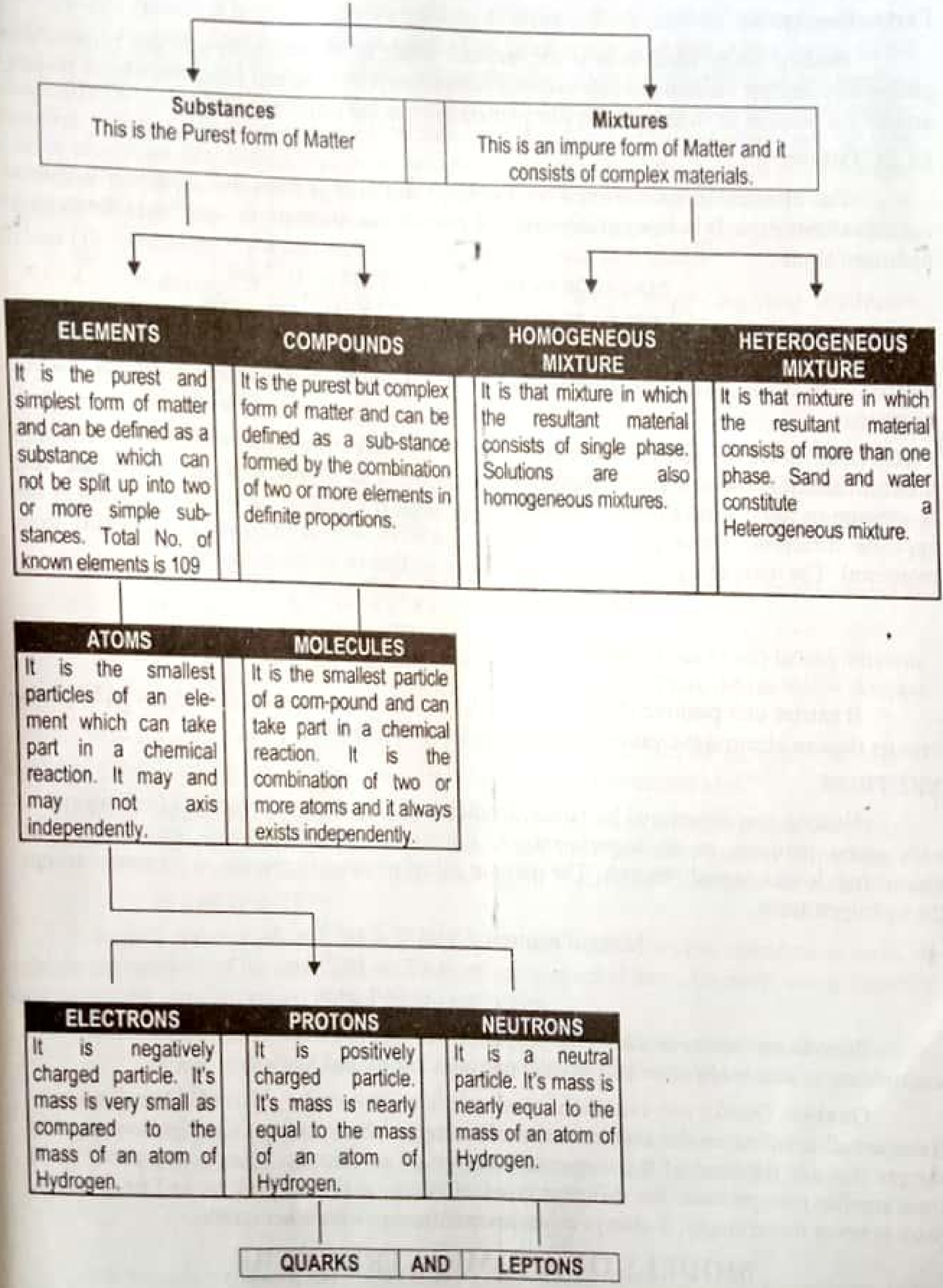
IS MADE UP OF THE FOLLOWING SCHEME

Greeks Concept of Matter



Classical Concept of Matter

Passage of Time



Substances
This is the Purest form of Matter

Mixtures
This is an impure form of Matter and it consists of complex materials.

ELEMENTS
It is the purest and simplest form of matter and can be defined as a substance which can not be split up into two or more simple substances. Total No. of known elements is 109

COMPOUNDS
It is the purest but complex form of matter and can be defined as a sub-stance formed by the combination of two or more elements in definite proportions.

HOMOGENEOUS MIXTURE
It is that mixture in which the resultant material consists of single phase. Solutions are also homogeneous mixtures.

HETEROGENEOUS MIXTURE
It is that mixture in which the resultant material consists of more than one phase. Sand and water constitute a Heterogeneous mixture.

ATOMS
It is the smallest particles of an element which can take part in a chemical reaction. It may and may not axis independently.

MOLECULES
It is the smallest particle of a com-pound and can take part in a chemical reaction. It is the combination of two or more atoms and it always exists independently.

ELECTRONS
It is negatively charged particle. It's mass is very small as compared to the mass of an atom of Hydrogen.

PROTONS
It is positively charged particle. It's mass is nearly equal to the mass of an atom of Hydrogen.

NEUTRONS
It is a neutral particle. It's mass is nearly equal to the mass of an atom of Hydrogen.

QUARKS AND LEPTONS

Parts of an Atom:

Nestled inside each atom is the nucleus, made up of positively charged protons and electrically neutral Neutons. Atom also contains negatively charged electrons which revolve around the nucleus in various shells like planets around the sun.

ELECTRONS:

The electron was discovered by J.J. Thomson (1897) from the experiments carried out on cathode rays. It is a negatively charged particle and its mass is $^1/_{1837}$ times the mass of hydrogen atom.

Mass of an electron = 9.109535×10^{-28} gm.
Charge on an electron = 1.602×10^{-19} coulombs.

Since an atom is electrically neutral, the number of electrons is equal to the number of protons and this is the characteristic of an atom of an element and is called the Atomic number.

PROTONS: Since the atom is electrically neutral so there must be some positive particle in the atom also. Goldstein (1886) discovered proton when he found, in a discharged tube, that is addition to cathode rays there were positive rays (also called as canal rays) moving in the opposite direction. These positively charged particles are called protons (derived from protoium). The mass of a proton is nearly the same as that of hydrogen atom.

Mass of Proton = 1.672×10^{-24} g
= 1.672×10^{-27} kg
= 1.00728 amu

- It carries unit positive charge equal to 1.602×10^{-19} coulombs. It is about 1837 times heavier than an electron the value of a proton is 1.5×10^{-38} cm^3.

NEUTRON

Neutron was discovered by James Chadwick (1932) when he bombard Berllian atoms with alpha particles in an experiment. A sub-atomic particle having no charge was discovered. It was named Neutron. The particle called neutron is present in all atoms except the hydrogen atom.

Mass of neutron = 1.672×10^{-24} g
= 1.672×10^{-27} kg
= 1.00866 amu

Protons and neutrons are about 100,000 times smaller than atoms. Even protons and neutrons are in turn made up of still smaller particles known as Quarks.

Quarks: Quarks are extremely small particles that make up protons and neutron. These are also called as the smallest units of matter in the universe. Quarks have electric charges that are fractions of the elementary charge of an electron. Quarks are about 1000 times smaller than protons. Six different types of quarks make up protons and neutrons. A quark is never found singly, it always exists in combination with other quarks.

MODELS OF ATOMIC STRUCTURE

Over the years, scientists have developed models of the atom to understand the distribution of electrons, protons and neutrons in an atom.

Rutherford's Atomic Model. According to **Ernest Rutherford** (1913): (a) Atom is hollow and spherical, **(b)** Nearly all the mass of an atom is concentrated at the centre of the atom; called **nucleus**, (c) The nucleus is surrounded by electrons travelling at tremendous speeds, **(d)** The centrifugal force required for their circular motion is provided by electrostatic attraction between positively charged nucleus and negatively charged electrons, (e) The positive charge on the nucleus is equal to the atomic number (z) of the element or the number of protons in the nucleus of the atom, (f) Rutherford's nuclear model is also known as **Planetary model**, because it is comparable to the **selar system** on a miniature scale with the nucleus corresponding to the sun and the revolving electrons, the planets.

- **Nucleus.** (a) Nucleus is a small positively charged part of the atom, (b) **James Chadwick** (1932) discovered that nucleus also contains neutrons, (c) The protons and neutrons in the nucleus are collectively known as **nucleons.** (d) The **volume** of the nucleus is about $\mathbf{10^{-36} cm^3}$ and that of atom is $\mathbf{10^{-24} cm^3}$. (e) The **density** of the nucleus is about 10^{14}g per cm^3, (f) **Instability** of the nucleus is due to high neutron proton ratio.
- **Atomic Radii.** Atomic radii are of the order of 10^{-8}cm (1 A°) and radii of the nuclei are nearly $\mathbf{10^{-13} cm}$. Radius of the nucleus is thus 1/100,000th of the radius of atom.
- **Atomic Number (Z) and Mass Number** (A) The number of protons present in an atom.
- **The number of protons (Z) + the number of neutrons (A-Z) in any nucleus is known as the mass number (A) of the atom. Thus, Mass No. = Atomic No. + No. of** neutrons.

For example, the mass number of carbon is 6. Thus, No. of protons = 6, No. of neutrons (A-Z) –12 – 6 = 6, No. of electrons = 6. It can be represented as ${}_6C^{12}$

- **Isotopes.** Atoms of the same element having same atomic number but different mass numbers are called **isotopes.** They have the same number of protons but differ in the number of neutrons, e.g., ${}_8O^{16}$, ${}_8O^{17}$, ${}_8O^{18}$. *Isotopes were discovered by* **Soddy** in 1911.

Bohr's Atomic Model. Bohr (1913) gave new idea of atomic structure in order to explain the stability of the atom and emission of sharp spectral lines. He made use of Planck's quantum theory and proposed the following postulates

(a) The electron in an atom revolve around the nucleus in certain discrete orbits. Such orbits are known as stable orbits or non-radiating orbits or stationary orbits.

(b) An electron can move only in those permissible orbits in which the angular momentum *(mvr)* of the electron is an integral multiple of h/2π. Thus,

$$mvr = n\frac{h}{2\pi}$$

Where, m = mass of the electron, r = radius of the electronic orbit, v = velocity of the electron in its orbit. The angular momentum can be $\frac{h}{2\pi}, \frac{2h}{2\pi}, \frac{3h}{2\pi}, \ldots \frac{nh}{2\pi}$. This principle is known as quantization of angular momentum. In the above equation VT is any integer which has been called by Bohr as Principal quantum number. It can have the values: n = 1, 2, 3.... (from the nucleus). Various energy levels are designed as **K (n = 1), L (n = 2), M (n-= 3)** ..... etc. Since the electron present in these orbits is associated with some energy, these orbits are called energy levels.

(c) The emission or absorption of radiation by the atom takes place when an electron jumps from one stationary orbit to another.

(d) The radiation is emitted or absorbed as a single quantum (photon) whose energy *hv* is equal to the difference in energy ΔE of the electron in the two orbits involved. Thus

$$Hv = \Delta E$$

Where 'h' = Planck's constant, v = frequency of the radiant energy. Hence the spectrum of the atom will have certain fixed frequency.

(e) The lowest energy state (π=1) is called the ground state. When an electron absorbs energy, it gets excited and jumps to an outer orbit. It has to fall back to a lower orbit with the release of energy.

WAVE MECHANICAL CONCEPT OF ATOM

Electromagnetic Radiations. Ordinary light, **X-rays, γ-rays, visible light, UV light, in radar waves and radio waves** are called electromagnetic radiations because when they pass through a point in space, they produce oscillating electric and magnetic fields at that point. Electromagnetic radiations do not require any medium for their propagation and have wave characteristics, *viz.*

(a) Wavelength (λ). *It is the distance between two successive crests or troughs.* Wavelength of visible light (3800 A° to 7600 A°) determines its colour. Wavelength of radiations is inversely related to its energy. It is measured in **cm. Angstrom** A° (1 A° = 10^{-8}cm. = 10^{-10}m), **nanometre (nm) or millimicron (mμ) (1 nm or 1 mμ = 10^{-9} cm = 10^{-9}m)** or micron (μ) (1μ = 10^{-4}cm= 10^{-6}m).

(b) Frequency (v). *The number of waves that pass through a given point in one second is known as frequency.* The frequency of a wave is inversely proportional to its wavelength, i.e., $v \; a \; \frac{1}{\lambda}$. Frequency is expressed in **cycles per sec. (cps) or Hertz (Hz), megacycle sec. or mega Hertz (MHz).** 1 MHz = 10^6 cps.

(c) Velocity (c). *The distance travelled by a wave in one second is called its velocity.*

$$c = v\lambda \text{ or } v = \frac{c}{\lambda} \text{ or } \lambda = \frac{c}{v}$$

The velocity of all types of electromagnetic radiations is found to be a constant in vacuum i.e., 3×10^{10} cm sec^{-1} or 3×10^8 ms^{-1} or 186000 miles sec^{-1}. As c=vλ, the greater the wavelength the smaller the frequency.

(d) Wave Number ($\bar{v}$). *It is defined as the number of wave lengths per cm. It is equal to the reciprocal of wave length expressed in cm.*

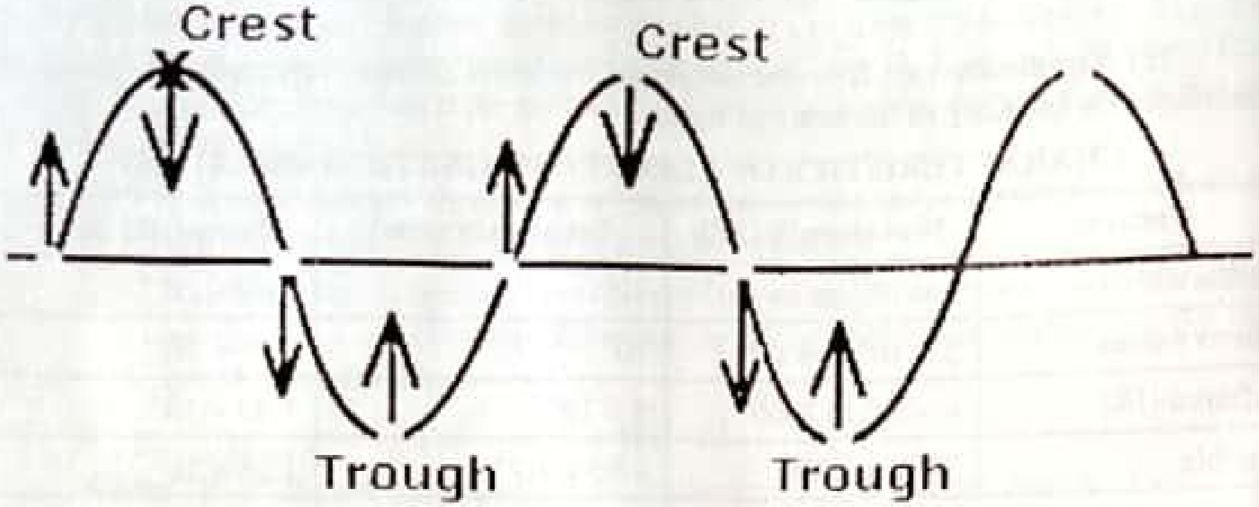
$$\bar{\nu} = \frac{1}{\lambda} \text{ since } \lambda = c/\nu \quad \therefore \bar{\nu} = \nu/c$$

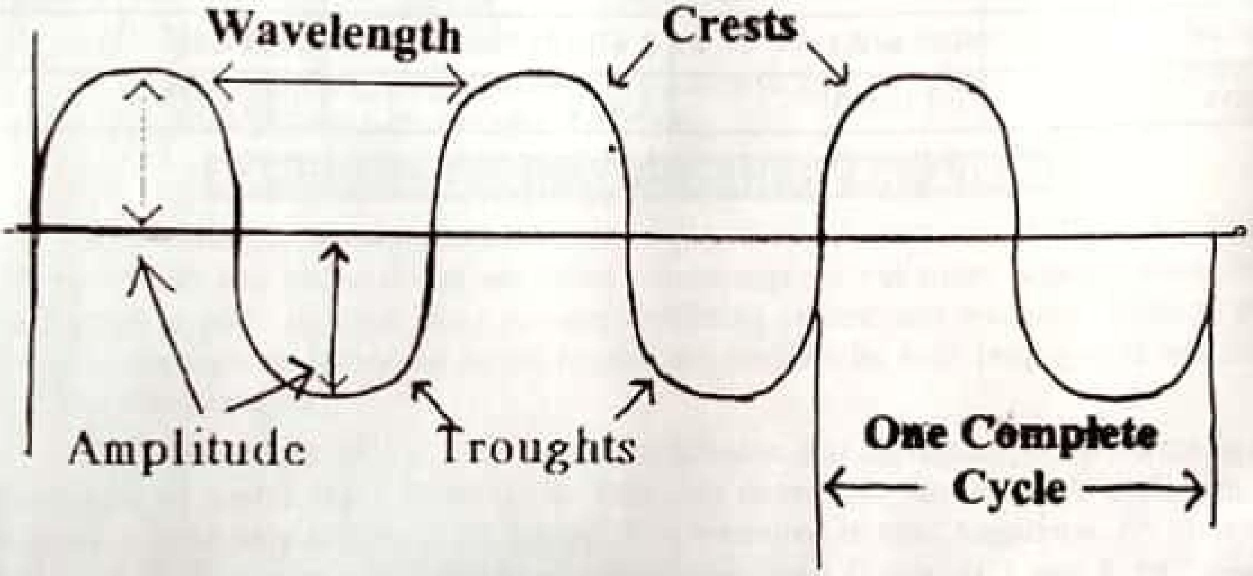
(e) Amplitude *(a). It is the height of the crest or depth of trough of a wave.* It determines the intensity of the beam of light.

CHARACTERISTICS OF ELECTROMAGNETIC RADIATIONS

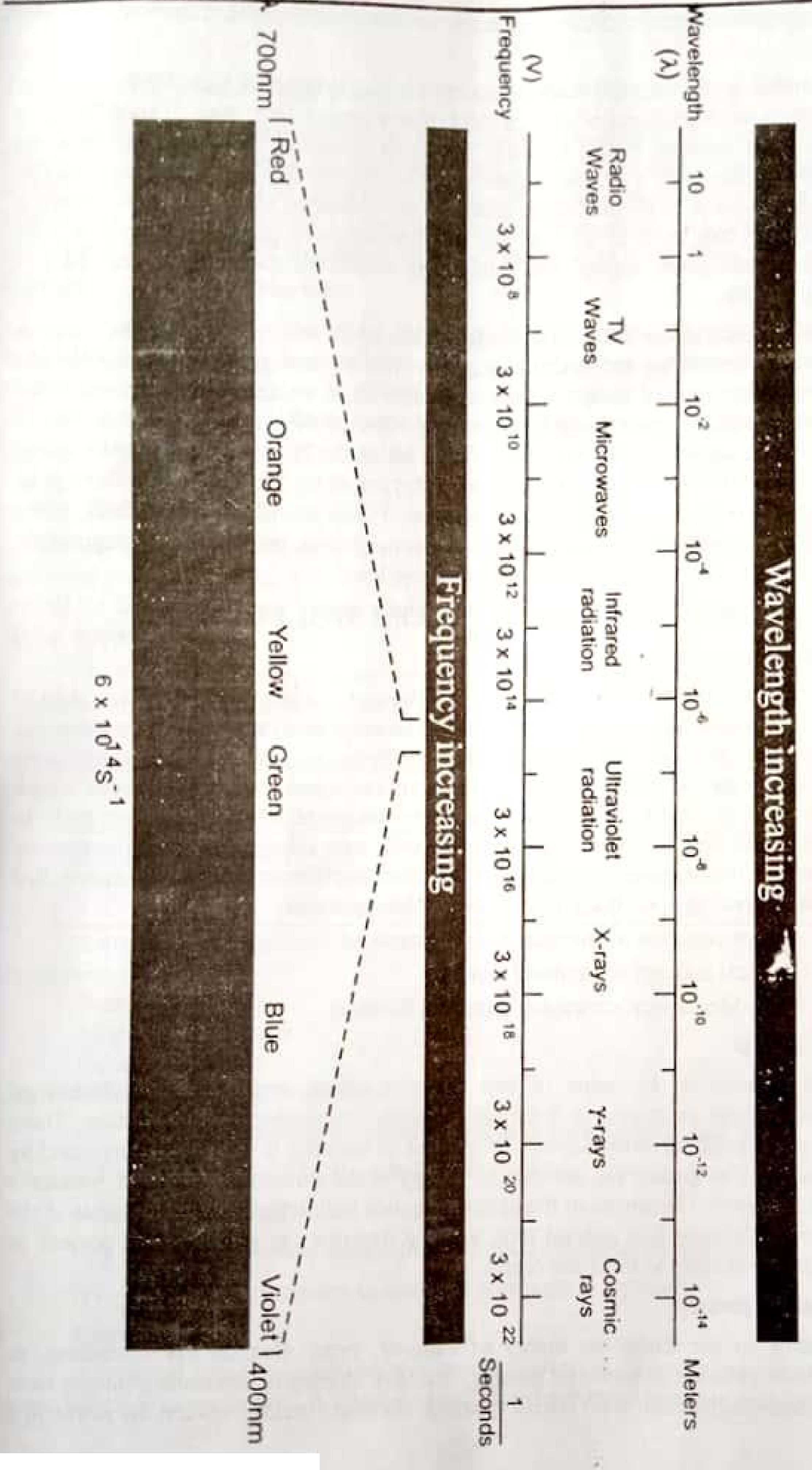
Nature	Wavelength (A°)	Frequency (sec)	Energy (kj mole^{-1})
Radio waves	3×10^{14} to 3×10^{9}	10^{5}	3.99×10^{-8}
Micro waves	3×10^{9} to 6×10^{6}	10^{9}	3.99×10^{-4}
Infrared (IR)	6×10^{6} to 7600	5×10^{11}	1.99×10^{-1}
Visible	7600 to 3800	3.95×10^{14}	1.58×10^{2}
Ultra violet (UV)	3800 to 150	7.9×10^{14}	3.16×10^{2}
X-rays	150 to 0.1	2×10^{16}	8.89×10^{3}
γ-rays	0.1 to 0.01	3×10^{18}	1.20×10^{6}

PICTORIAL REPRESENTATION OF A WAVE





This wave is moving in this direction ⟶


Wavelength increasing
Wavelength (λ)
10
1
10^-2
10^-4
10^-6
10^-8
10^-10
10^-12
10^-14
Meters
Radio Waves
TV Waves
Microwaves
Infrared radiation
Ultraviolet radiation
X-rays
γ-rays
Cosmic rays
Frequency (ν)
3 x 10^8
3 x 10^10
3 x 10^12
3 x 10^14
3 x 10^16
3 x 10^18
3 x 10^20
3 x 10^22
1/Seconds
Frequency increasing
700nm
Red
Orange
Yellow
Green
Blue
Violet
400nm
6 x 10^14 s^-1

ELEMENTS

An element is the simplest form of matter and is made up of same kinds of atoms. Elements are the basic ingredients of the universe. Every object, from stars to snowflakes, is formed from one or more of the 92 naturally occurring elements; another 26 elements are man-made. Each element has a unique internal atomic structure that determines its chemical properties. Eighty percent of all the known elements are classified as metals. Metals conduct heats electricity and can bend or stretch. The non-metals show greater variations in their properties and include gases, liquids and solids. The metalloids combine the properties of metals and non-metals.

In 1869 Russian scientist Dmetri Mendeleen devised a way of arranging the elements which reveals their underlying properties at a glance. His method gave birth to the Periodic table of elements that is used today. It puts the elements in vertical and horizontal rows called groups and period, respectively in increasing order of their atomic numbers. Ninety two elements of the periodic table have been found on earth. In Earth's crust, just eight of these account from 90.5 percent of the total mass. Oxygen is the most abundant element of earth and Hydrogen is the universe. Silicon is the second most abundant element found in the crust of the earth, followed by aluminium, iron, calcium, sodium, potassium and magnesium. All other elements appear in quantities of one percent or less.

ATOMS COMBINE TO FROM MOLECULES

Chemical Bonding:

Atom is the smallest building block of elements, while molecules are that of compounds. For example, the molecule of water H_2O (a compound) consists of two hydrogen atoms joined together to one atom of oxygen chemical. Hydrogen gas burns with a blue flame while oxygen gas helps in burning but when they combine together, they form water which extinguishes fire. This clearly shows that when elements combine together chemically to form new compounds they lose their identity because the new substance formed has entirely different properties. When molecules are found they involve different kinds of linkages called chemical bonds depending upon the nature of the combining atoms.

There are two concepts of chemical bonding namely:

(i) Classical concept of chemical Bonding.

(ii) Wave-Mechanical concept of chemical Bonding.

CHEMICAL BOND

Chemical bond is the union of two or more atoms involving redistribution of electrons between them producing a force which holds the bonded atoms together. These combinations give variety of compounds. The process of bonding is usually accompanied by decrease in energy. The greater the decrease in energy in the formation of a bond, greater is the strength of the bond. The nature of the chemical bonds will depend upon the nature of the combining atoms. Valency is a general term used to describe the power atoms possess of combining with one another to form molecules.

Types of Chemical Bonds:

According to the electronic theory of valency, every element has a tendency to acquire stable inert gas configuration by gaining, losing or sharing of electrons from one atom to the other. Accordingly there are THREE types of chemical bonds between the atoms in a molecule.

1. Electrovalent or Ionic Bond:

According to Lewis concept, an Ionic Bond is established as a result of the complete transference of one or more electrons from one atom to the other. Good ionic bonds are formed between metals and non-metals. Atoms of metal generally lose electrons (become cation) and those of non-metals gain electrons (become anion) and then as a result these cations and anions are held together by strong electrostatic forces of attractions.

Formation of Sodium Chloride:

Sodium chloride is formed by the complete transfer forne electron from sodium atom to chlorine atom. Sodium is a well-known metal atom while chlorine is a non-metal. The atomic number of sodium atom is 11 and its electron break-up in shells is 2,8,1 while that of chlorine atom is 2,8,7. Sodium atom has one electron in the outermost shell which is transferred to yield the new break-up like

Sodium (Na) = 2, 8
Chlorine Cl = 2, 8, 8

By doing this, sodium is converted into sodium ion (cation) and chlorine atom is converted into chloride ion (Anion) which are then held together by electrostatic forces of attractions thereby forming a three dimensional crystal lattic of sodium chloride which is highly stable.

A chemical equation can be written to describe this reaction in terms of chemical symbols and electronic configurations as follows:

$Na + Cl$	$\longrightarrow$	$Na^+ + Cl^-$	$\longrightarrow$
Sodium Chlorine 2,8,1 2,8,7		Cation Anion 2,8 2,8,8	
N_a^+ Cl^- +	. +	Lattice Energy Exothermic reaction –761.7kjmole^{-1}.	

Salts are formed by ionic bonds.

Examples:

Potassium chloride
Magnesium Bromide
Calcium Iodide

Characteristics of Ionic Compounds

(i) These compounds are usually soluble in polar solvents like water
(ii) They have high melting and boiling points.
(iii) They are usually hard crystalline solids.
(iv) Solutions of these compounds are good conductor of electricity.
(v) Ionic bonds are more common in inorganic compounds.

2. Covalent Bond

A covalent Bond is formed by the mutual sharing of electrons between two atoms of comparable electro-negativity. A covalent bond may be formed between similar or dissimilar atoms.

Sharing of electrons may occur in three ways:

(a) The covalent bond formed by sharing of one pair of electron is called a single bond.

(b) By sharing of two pairs of electrons is called a double bond.

(c) By sharing of three pairs of electrons is known as triple bond.

Formation of Hydrogen, Oxygen and Nitrogen molecules involves the formation of single, double and triple covalent bonds respectively.

Hydrogen Molecule	H_2, $H-H$
Oxygen Molecule	O_2, $O=O$
Nitrogen Molecule	N_2 $N\equiv N$

Characteristics of Covalent Compounds:

(i) Organic compounds have low melting and boiling points.

(ii) Strength of the covalent bond decreases with the increase in bond strength.

(iii) They are soluble in organic solvents.

(iv) They are poor conductors of electricity.

(v) Reactions between covalent compounds are slow and often incomplete and reversible.

3. COORDINATE COVALENT BOND

This is a special type of covalent bond there, although both the electrons forming the bond are coordinated only by one atom, these are shared by both the atoms. Thus it involved one-sided sharing of the lone of electrons. The atom that donates the electron pair is known as donor and the atom which accepts the electron pair is called the coordinate covalent bond is shown by means of an arrow (→) pointing away from the donor atom to the acceptor atom. Common examples are

Water	H_2O
Sulphur-dioxide	SO_2
Ammonium ion	NH_4^+
Sulphuric acid	H_2SO_4

Characteristics of Coordinate Compounds:

(i) They are sparingly soluble in water and more soluble in organic solvents.

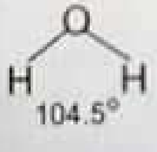
(ii) Coordinate covalent bond is rigid and directional.

(iii) They do not form ions in water.

WATER: Wonderful Liquid with Amazing Properties:

Molecular Formula: H_2O

Structural Formula:



Water plays a vital role in the various physical and chemical processes taking place around us. Life itself depends upon water. The major constituent of both plants and animals, water is also found in tremendous quantities in rivers, lakes, oceans, underground water supplies and the polar icecaps.

Physical properties of Water:

Property	Value
Density (liquid)	0.9970 g ml^{-1} at 25°C
Melting point (freezing)	0.000oC at 1 atm
Boiling point 100.0oC at 1 atm	
Heat of fusion1.436 kcal $mole^{-1}$ (6.008 kj $mole^{-1}$)	
Heat of vaporization	9.720 kcal $mole^{-1}$ (40.668 kj $mole^{-1}$)
Specific heat 1.000 cal g^{-1} C^{-1} (4.186 j g^{-1} °C–1)	
Density of solid	0.917 g ml^{-1} at 0°C
Surface tension	72.8 erg cm^{-2}
Dielectric constant	78.54 at 25°C

Why does ice float over Water?

The fact that ice occupies more space in the refrigeration tray when does the liquid water illustrates the increase in volume of a sample of water on freezing. Then is an abnormal volume change in the liquid phase as water is cooled below 3.98°C. As the temperature of a sample of water is lowered, the water contracts until a temperature of 3.98°C is reached. Farther cooling brings about an expansion unlike most liquids, until 0.00°C, the freezing point of water at one atmosphere, is reached. At this temperature, continued removal of energy from the sample causes the water to freeze (crystallize). In contrast most liquids, water expands when it crystallizes; the expansion amounts to about 9%.

The density of water is maximum at 3.98°C or 4°C and the density of water decreases as the volume increases when the water is either heated or cooled from that temperature.

At 0.00°C the density of water decreases sharply as the volume increases when liquid water (d = 0.9998 g ml^{-1}) crystallizes to form Ice (d = 0.917 g ml^{-1}).

EXERCISE

Q. Differentiate clearly among Energy, Force, Work, Power and Pressure?

Ans. All these terms are sometimes synonymously used by the layman but every term has a separate scientific meaning which is explained as follows:

Energy:

It may be defined as the property of a system that is a measure of its capacity of doing work. It is measured in Joules. Energy can have various forms like heat, light, potential, Kinetic and electrical.

Force:

Force may be defined as Push or Pull. Force is needed to break the inertia of a system. It is measured in Newton.

Work:

It may be defined as the product of force and distance, it is measured in Joules. The amount of work done depends on.

(i) The size of the force which is used.

(ii) The distance through which the object is moved.

Power:

It is the rate of doing work in a unit time. It is the pressure measured in watts and kilowatt (KW). It is the force exerted on a unit area. If a force of one Newton acts on one square metre. It results in pressure of one Pascal.

Q. Define Newton?

Ans. Newton is the unit of force. One Newton is the force needed to move one kilogram mass one metre per second faster every second.

Q. What is Horse Power?

Ans. An engine which could do work equal to lifting 550 pounds one foot per second, is said to work at the rate of one horsepower. This unit of power is used in U.K. and U.S.A.

Q. What is kilowatt-hour? Explain with an example?

Ans. A 100-watt light bulb lighted for one hour uses 100-watt-hours of electricity. Since the watt-hour is a small unit, another unit is used to 1000 watt-hours. This unit is called a Kilowatt-hour. This much energy used counts one unit in the electric Metre.

Energy Calculations: In a typical example, a Toaster oven uses 800 watts of power for 2 minutes, Energy used is:

E = power × time

E = 800 × 2

E = 16000 watt minutes.

1600 watt-minutes = 1600 × lkw/1000 w × 1 hour/60 minutes = 0.026 kW of electric energy.

Q. **What is the most popular form of energy?**

Ans. Electricity is the popular form of energy and it is fundamental to modern life. It is a uniquely valuable, versatile and controllable form of energy, which **can** be **asked** to perform **many** tasks efficiently.

Q. **Can we create or destroy energy?**

Ans. Energy may change in form but it cannot be destroyed. A power station does not create the electrical energy that we use in our homes. The power station actually changes the chemical energy of the fuel into electrical energy. When the electricity so produced is used up, it is not destroyed but instead it changes into another form of energy, such as heat or light.

Q. **What organisations are responsible for the supply of electricity in Pakistan?**

Ans. The total installed capacity of the country power network is about 20000 megawatts and is increasing each year. It was 113 MW in 1948.

Q. **What are the electricity production capacities of Mangla and Tarbela Dam?**

Ans. Electricity production capacities of

Mangla Dam = 1200 MW
Tarbela Dam = 2150 MW

Q. **Give the names of the Dams which will be built in future?**

Ans. Bhasha Dam (Capacity: 3,360 MW)
Kalabagh Dam (Capacity 3,600 MW)
Satpara Dam (Capacity 644 Giga Watt hour)

Q. **What are the additional advantages of Hydro Electric Power Generation?**

Ans. Hydro-electric power means production of electricity by making Dams. Its additional advantages are:

(i) It is cheaper.
(ii) It is pollution free.
(iii) Water can be used for Irrigation purpose.

Q. **What is Hub Power Project?**

Ans. To overcome the power crises in the country, a private Power cell has been established to explore and engage additional resources in the power generation. It is now working on the Hub Project. It will carry a generation capacity of 1200 MW.

Q. **What is a Turbine?**

Ans. It is a rotary engine actuated by the reaction or impulses or both of a current of fluid; water or steam. Turbines are most efficient engines. Turbines transform the kinetic energy of water and steam to mechanical energy.

Q. **What are Isotopes?**

Ans. Each element has its own characteristic number of protons and an equal number of electrons. If you change these numbers, you change the element involved. However, the number of neutrons in the atoms of a given element is able to vary. Atoms that have the same nuclear charge but a different number of neutrons are called Isotopes. Two famous isotopes of Uranium element are Uranium-235 and Uranium-237.

Q. **What are the main fissionable materials involved in the production of Nuclear Energy?**

Ans. These are Uranium-235 and Plutonium-239. The later is superior to the former as a nuclear fuel.

Q. **What is the percentage of Uranium-235 fuel for commercial reactor?**

Ans. Commercial reactors are powered by fuel containing 1.6-5.5% Uranium-235. Nuclear submarines use more enriched fuel; 9.3% Uranium-235.

Q. **How do you compare Fission with Fusion for the production of Nuclear Energy?**

Ans. The process of Nuclear Fusion should be preferred over Fission for the production of Energy for two main reasons. It involves cheaper and abundant raw materials and pollution free waste products.

Q. **What is Heavy Water?**

Ans. It is deuterium oxide (D_2O). Hydrogen of water molecule is replaced by its heavier isotope, Deuterium. Heavy Water is used as a coolant in nuclear power plants.

Q. **How much energy will be produced by the nuclear fission of one gram of Uranium-235?**

Ans. It will generate about 2×10^7 k Calories of heat. This much heat can be produced otherwise by the combustion of 3 tones of coal. One kilogram Uranium-235 is equivalent in energy content to 18,700 tons of TNT.

Q. **What is KANUPP?**

Ans. KANUPP Stands for Karachi Nuclear Power Plant — it produces about 0.2% of the total electricity produced in Pakistan.

Q. **What is an electric Fuse?**

Ans. Homes are protected against overloaded circuits by automatic switches that open whenever the current into the wires becomes dangerously large one of the most common types of automatic switches is called an electric fuse. An electric fuse contains a strip of metal.

Q. **What are circuit Breakers?**

Ans. Circuit breakers are now installed in many new homes in place of fuse boxes. A circuit breaker is more convenient than a fuse because the automatic switch can be closed again by pushing a knob.

Q. **What are Windmills?**

Ans. Windmills have been used to produce electricity since the early 1900s. It is easy to produce electricity from a wind generator. This is simply a windmill that converts the kinetic energy of the wind into electrical energy.

Q. **What is Geothermal Energy?**

Ans. It is the utilization of the heat of the Earth. Cold water is pumped through the Earth and is heated up by hot rocks. Another pipe brings the hot water or steam to the surface. The steam comes out at high pressure and is used to drive steam turbines for the generation of electricity.

Q. **What is meant by reprocessing?**

Ans. It is a process in which the fissionable product is recovered from the spent nuclear reaction fuel by chemical dissolution. It generates highly radioactive wastes that must be solidified for final disposal.

Q. **Name some Petrochemicals?**

Ans. Petrochemicals are the substances which are obtained during the refining of crude petroleum. Typical, examples are Ether, Benzene, Xylene, Toluene and Ethylene.

Q. **Name some fractions from an oil refinery with their boiling points?**

Ans. Some of the fractions from an oil refinery are given below with their boiling points:

Oil factions	Boiling points
Petrol b.pt.	40-75°C
Kerosene b.pt.	125-175°C
Diesel b.pt.	175-250°C
Lubricating oil b.pt.	250-300°C
Bitumen b.pt.	More than 350°C

Q. **What is Biomass?**

Ans. It is source of energy that comes from plants and animals CO_2 and oil are forms of biomass energy, because they come from plants and animals that lived million of years ago. Dried seaweed is an example of biomass. Another example is dried animal dung, which is used in many countries in Africa and Asia as a fuel for cooking.

Q. **What is Energy Conservation?**

Ans. It is the process in which energy is used most efficiently without any wastage in home appliances. It can be done as follows:

(i) By using improvised/compact fluorescent electric bulbs.

(ii) By the efficient use of electricity.

(iii) By leading a simple life.

(iv) By using automated-control systems in appliances. Asia could save billions of US dollars by conserving electricity.

(v) By using light emitting diodes (LEDs)

⇒ Replace fluorescent bulbs with energy Sonex bulbs.

Q. **What is Electromagnetic Energy?**

Ans. The air contains millions of tiny, fast moving particles. Waves of energy pass through the air, too. This kind of energy, called electromagnetic energy is made of vibrations of electricity and magnetism. That is a whole range of different electromagnetic waves.

MODERN MATERIALS AND CHEMICALS

CERAMICS

DEFINITION:

Ceramics include a wide range of inorganic, non-metallic materials whose manufacture requires heating at high temperature. Earthy raw materials used in its manufacture contain predominantly silicon with its oxides and complex compounds known as silicates.

Varieties of Ceramics:

More common varieties of ceramics are detailed below:

Raw materials for various ceramics are Clay, Feldspar, Quartz, Sand and Iron.

SR. NO.	VARIETY OR GROUP	TYPICAL EXAMPLES
1.	Structural Clay Products	Brick, tile, terra cota, glazed architectural brick
2.	White wares	Dinnerware, Chemical and electrical porcelain (Sparkplugs, Sanitary ware and Floor tile).
3.	Glass	All sorts of glass products
4.	Porcelain Enamels	A substantially vitreous inorganic coating with a glass like fire polished surface.
5.	Refractories	Alumina, Silicon Carbide and Silica.
6.	Abrasive materials	Fused alumina, Silicon Carbide and related products.
7.	Aluminium Silicate Fibers	Ultra particles and ceramic foams.
8.	Cement, lime	Portland cement, lime, plaster and gypsum products.

Pottery:

Pottery is also an important category of ceramics. It includes earthenware, stoneware and porcelain. Main steps involved for pottery formation are Forming, Drying and Firing. Porcelain is potassium-aluminum silicate.

Cheap Raw Materials:

The raw materials for structural ceramics are incredibly abundant. Spectacular abundance of silicon in sand and in many minerals makes a cheap, unlimited resource, combined with other materials, for ceramics. The most common material is silicon, about 28% of the Earth's crust by weight. It is found in sand and other silicates. Nitrogen, another super ceramic ingredient, is 78% of the atmosphere (by volume). Carbon, also used, is plentiful, too. By contrast, iron needed for steel makes up only 5% of the Earth's crust.

Glass:

Glass is a ceramic material consisting of a uniformly dispersed mixture of silica, soda ash and lime often combined with some metallic oxides.

Technically, glass is an amorphous, super cooled liquid of extremely high viscosity which has all the appearance of a solid.

Composites:

Composite materials are defined as the combination of two or more mutually macro constituents that differ in physical form and chemical composition. A material that results when two or more materials, each having its own, usually different characteristics, are combined in order to provide the composite with useful properties for specific applications. Advanced composites are a class of structural high performance fibrous forced plastic or metallic materials. Fiberglass is an example of composite material.

LATEST APPLICATIONS OF CERAMICS

1.	Super-hard ceramics make excellent cutting tools and bearing.
2.	New integrated circuits that use ferroelectric ceramics store data in a computer permanently whenever power is switched off.
3.	Ceramics have proven to be ideal host for the fluorescent ions needed in lasers. Ruby is used for laser materials.
4.	A ceramic engine would have more efficiency.
5.	Ceramics find increasing use as thin coatings on objects made of conventional materials. These are coated with titanium nitride, a ceramic that extends the cutting life 5-fold over steel.

ELECTRICAL PROPERTIES OF MATERIALS

INTRODUCTION

Electricity is fast moving electrons. It is the most popular form of energy and it can be easily converted into all other kinds of energies. Materials can be classified into the following three categories when electricity is passed through them.

(1) Conductors

Those materials which allow the electricity to pass through them easily without much resistance are called conductors. Most metals like copper, aluminum, iron, silver, gold and their alloys are conductors.

(2) Insulators

Those materials which do not allow the electricity to pass through them are called insulators. They actually offer a very high resistance to the flow of electric current. Typical examples of insulators are rubber, mica, glass, plastic, wood and paper.

(3) Semi-Conductors

Those materials which allow the electricity to pass through them only partially, are called semiconductors. Their conductance lies in between the conductors and insulators. Typical examples are silicon, Germanium and Selenium.

SEMI-CONDUCTORS

Definition:

"Semi-conductor is a material, may be an element or a compound that conducts electrical current less easily than does a metal such as copper or aluminum but much better than an insulator such as glass or wood. Most metals have quite high conductivity, while substances like diamond and mica have very low conductivity, due to high resistance.

Between these extremes lie the semi-conductors. Typical examples are silicon carbide. The resistivities of the semi-conductors range in between 10^{-1} to 10^{9} Ohms/cm. Slight impurities (in traces) in the crystalline structure impart characteristic properties to semi-conductors the semi-conductor is designated n-type or p-type depending on the electrical nature of the holes or energy deficits in the crystalline lattice.

DOPING

It is a process in which slight impurities are added into the pure semi-conductors to boost up their conducing properties. N-type and P-type semi-conductors are obtained in this way.

N-TYPE SEMI-CONDUCTORS

When pure silicon and germanium semiconductor crystals are dopped with electron-donor impurities like arsenic and antimony, N-type semiconductors are formed. In these substances, electrons act as charge carriers.

P-TYPE SEMI-CONDUCTORS

When pure silicon and germanium semiconductor crystals are doped with electron-deficient purities like Boron and Indium, P-Type semi-conductors are formed. The conduction in such substances takes place due to motion of holes which have like positive charges.

General Characteristics:

1.	The functioning of semi-conductors involves the science of Solid State Physics.
2.	The elements Silicon, Germanium and Selenium are semi-conductors.
3.	The compounds Indium antimonide, Lead telluride, Cadmium sulphide and Gallium arsenide are well known examples of semiconductors.
4.	The most characteristic property of a semiconductor is a large increase in its electrical conductivity with temperature, this increase occurs over certain temperature ranges.
5.	The properties of semi-conductor follow from the structure of the material.
6.	Semi-conductors of Silicon, Germanium and Gallium phosphide with high purity and controlled atomic structures are extensively used in electronic industry.
7.	Semi-conductors can be doped with selected impurities during crystal growth to achieve desired properties.
8.	There are few organic semi-conducting compounds which contain significant amount of carbon-bonding and are also capable of supporting electronic conduction. Anthracene and Ziegler-catalyzed acetylene polymers are examples.
9.	Vacuum tubes have been replaced by transistors by the use of semi-conductors.

SUPER-CONDUCTIVITY

Super-Conductivity:

Super-conductor is a material that offers no resistance to electric current. Actually, no material on Earth carries that properly at ordinary temperatures. Only when materials are super-cooled to very low temperatures they turn into super-conductors. A typical example of a super-conductor is the high temperature (30 K) ceramic made from a mixture of Lanthanum, Barium, Copper and Oxygen discovered by Bednorz and S-Muller in 1986. This awarded them Nobel Prize in physics. Levitating trains and Nuclear Magnetic Resonance Imaging machines use super-conductors.

MEISSNER EFFECT

In addition, superconductors exhibit the Meissner effect in which they cancel all magnetic flux inside, becoming perfectly diamagnetic (discovered in 1933). In this case, the magnetic field lines actually travel around the cooled superconductor. It is this property of superconductors which is frequently used in magnetic levitation experiments.

THE COMMUNICATION SYSTEM

Introduction:

Communication is the process of giving and receiving information signal and message. Over the centuries, human beings have had to communicate. The earliest cave dwellers had to develop a language system in order to communicate. Although many devices and methods have been used to communicate, the voice is the most universal communication medium used by the people. Early means were by gestures, drums, fire and smoke. The flag system was used primarily on ships for communication purposes. Radio, Television and Telephone are electronic communication media. Mobile phone, internet communication

RADIO

The term radio covers the radiation and detection of signals propagated through space as electromagnetic waves to convey information. Like all other electromagnetic waves, a radio wave is made up of electric and magnetic fields vibrating mutually at right angles to each other in space. Radio signal intensity, like light intensity, decreases as the distance from the source increases. Radio waves are transmitted with the help of Antenna. A transmitting antenna is a device that projects as much as possible of the radio-frequency energy generated by transmitters into space. Frequency of the radio-waves is measured in Hertz. The frequenc of one cycle per second is written as one Hertz. The radio-frequency spectrum is divided in o a number of bands from very low frequencies to super high frequencies. For information to be transmitted, it must be attached to a radio-frequency carrier-wave, which is then transmitted in a given frequency channel. The carrier wave and information can be picked up by a receiver turned to this channel. The process by which the information is attached to the carrier wave is known as modulation.

TELEPHONE

The telephone is a device for reproducing sound at a distance from its source by means of the transmission of an electrical signal. The word refers both to the familiar handset and to the huge telephone system that makes possibly person-to-person communications throughout most of the world. There are approximately 400 million telephones world-wide. The telephone now in use is similar to the original device patented by Alexander Graham Bell in 1876 and 1877. The sound waves are converted into electrical oscillations, which can be sent long distance and travel about 900,000 times faster than sound. These oscillations are then converted back into sound waves at the receiving end. In modern telephone, the speaker talks into the mouthpiece, behind which is a transmitter. Vibrating air molecules produced by the speech generate vibrations in a thin aluminum diaphragm. These vibrations are transmitted to a small piston, which is the cover for a metallic box filled with small granules of carbon. Sound waves are converted into electrical signals which are converted back to sound waves against the receiving end, the ear piece. Mobiles and I-phones have converged the world in our hands.

TELEVISION

It is based upon the transmission of visible, moving images by electrical means. In 'closed circuit' television the transmission is by line, in 'broadcast' television it is by radio-waves. In either case, light waves are converted into electrical impulses by a television camera and reconverted into a picture on the screen of a cathode-ray tube in the receiver. The transmitter consists of equipment for broadcasting modulated radio-frequency electromagnetic radiations representing a complete television signal, which includes sound, vision and 'synchronizing signals. The receiver is based on the super heterodyne principle; the sound and vision signals being fed to separate intermediate frequency amplifiers, detectors, and out-put stages. A picture is made up of small dots called picture element. A picture contains about 525 lines and the beam reads these lines 30 times per second. It, therefore, produces 30 complete pictures per second.

RADAR

Radar is an object-detection system that uses electromagnetic waves specifically radio waves to identify the range, altitude, direction or speed of both moving and fixed objects such as aircraft, ships, spacecraft, mountain ranges, radio and TV towers, guided missiles, motor vehicles, weather formations, and terrain.

The radar dish, or antenna, transmits pulses of radio waves or microwaves which bounce off any object in their path. The object returns a tiny part of the wave's energy to a dish or antenna which is usually located at the same site as the transmitter.

The uses of radar include air traffic control, radar astronomy, air-defense systems, antimissile systems; nautical radars to locate landmarks and other ships; aircraft anti-collision systems, ocean-surveillance systems, outer-space surveillance and rendezvous systems; meteorological precipitations, radar altimeters, earth-skimming flight-control systems, guided-missile target-locating systems, and ground-penetrating radars.

COMMUNICATION SATELLITES

Communications satellite (sometimes abbreviated to **COMSAT**) is an artificial satellite stationed in space for the purpose of telecommunications. Modern communications satellites use a variety of orbits including geostationary orbits, Molniya orbits, other elliptical orbits and low (polar and non-polar) Earth orbits.

For fixed (point-to-point) services, communications satellites provide a microwave radio relay technology complementary to that of submarine communication cables. They are also used for mobile applications such as communications to ships, vehicles, planes and hand-held terminals, and for TV and radio broadcasting, for which application of other technologies, such as cable, is impractical or impossible.

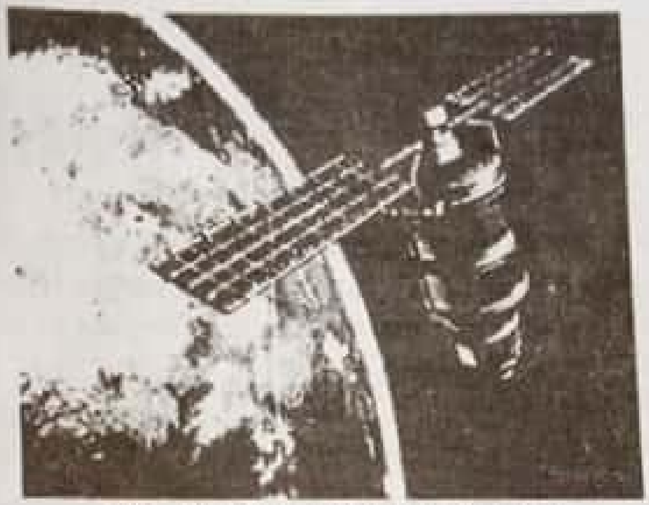


Fig. A Communication Satellite

SONAR

Sonar (originally an acronym for **So**und **N**avigation **a**nd **R**anging) is a technique that uses sound propagation (usually underwater, as in Submarine navigation) to navigate, communicate with or detect other vessels.

Two types of technology share the name "sonar": passive sonar is essentially listening for the sound made by vessels; active sonar is emitting pulses of sounds and listening for echoes.

Sonar may be used as a means of acoustic location and of measurement of the echo characteristics of "targets" in the water. Acoustic location in air was used before the introduction of radar. Sonar may also be used in air for robot navigation, and SODAR (an upward looking in-air sonar) is used for atmospheric investigations. The term sonar is also used for the equipment used to generate and receive the sound. The acoustic frequencies used in sonar systems vary from very low (infrasonic) to extremely high (ultrasonic).

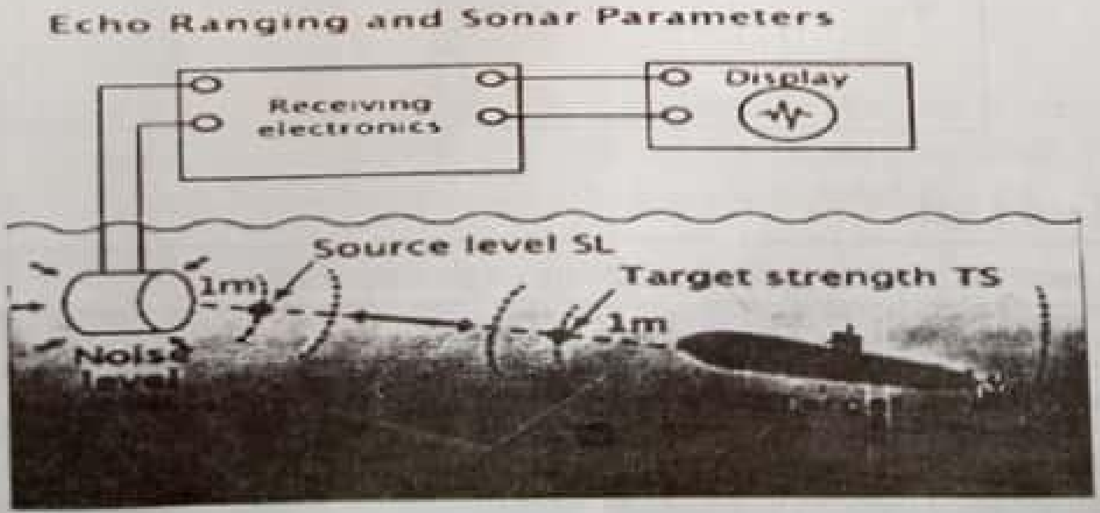


Fig. Working of Sonar

[redacted]

LASER

(Light amplification by stimulated emission of radiation)

Definition:

Laser is a device that generates "well organised" light or COHERENT l Ordinary white light is made up of many different colours. Each colour has a diff wavelength and the photons of each colour are out of step with each other. In a beam of l light, all the photon have the same wavelength and move in step, travelling along like a drilled army. The mechanism relies on a process known as Stimulated Emission and the laser is derived from Light Amplification by Stimulated Emission.

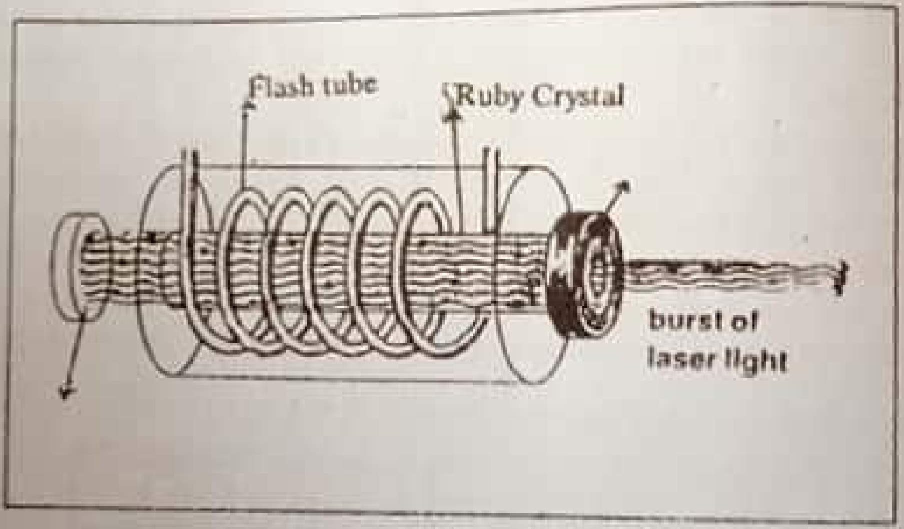
Mechanism of Stimulated Emission:

In Stimulated Emission, a photon emitted from an atom induces an electr another excited atom to fall immediately to a lower level and emit a photon identical to th Stimulated emission can thus be used to increase the number of emitted photons.

Energy is first pumped into laser material, raising most of the electrons return level just above the ground state. Initially, only a few atoms will spontaneously rad photons.

Two silvered end mirrors, one partially transparent reflect the radiation back forth repeatedly, inducing a chain reaction of photon emission. All the electrons return to ground state almost simultaneously and a powerful pulse of laser light emerges from partially transparent end.

Parts of a Laser:



Uses of Laser Light:

1.	A laser can produce light of essentially single frequency.
2.	Laser light is used in surveying and ranging.
3.	Dentists use a laser to remove decay from tooth.
4.	Laser light can be used to initiate thermonuclear reactions which occur only at a very high temperature.
5.	Laser light can be focused very accurately on a point, this can cut steel and surgeons

	can use laser light to perform very delicate operations.
6.	In eye surgery, a retina that has become separated or detached from the back of the eye can be welded back into place using a laser beam.
7.	Laser sources allow reproduction of three dimensional images. This technique is called Holography.
8.	Lasers are used for range-finding and target designation, and are being developed as both anti-satellite and ballistic missile defense weapons.

FERTILIZERS

Definition:

Fertilizers are the inorganic salts which contain elements essential for plant growth and which are introduced into the soil to obtain increased amount of crops regularly. Nitrogen, phosphorous and potassium containing minerals are especially important for normal plant life and are called as Primary Plant Nutrients. Secondary plant nutrients are calcium, magnesium, and sulphur. Trace elements like iron, copper, boron, magnesium, zinc and molybdenum are also among the 12 elements considered essential for plant growth. Fertilizers are of various kinds like.

NATURAL FERTILIZERS	NITROGENEOUS FERTILIZERS
These are naturally available organic and inorganic materials like plant matter, farm yard, manures, animal matter, rock phosphates and Chile saltpeter.	These are synthetically produced organic and inorganic materials like urea, ammonium nitrate etc,
ARTIFICIAL FERTILIZERS	**PHOSPHOROUS**
These are synthetically produced materials rich in nitrogen like ammonium sulphate.	These are synthetically produced materials rich in phosphorous like calcium superphos-phate and calcium dihydrogen phosphate.

CLASSIFICATION

Fertilizers can he classified according[1] to their mode of operation in the soil. They are as follows:

1. **Direct Fertilizers:**

These fertilizers which are directly assimilated by the plants are called direct fertilizers. For example super-phosphate, nitrates and ammonium compounds. These contain nutrient elements in the form of mineral salts which can be absorbed directly.

2. **Indirect Fertilizers:**

These are the substances which are introduced into the soil mainly to improve its mechanical, chemical or biological properties. Ground dolomite and limestone are used to reduce soil acidity, and gypsum is used to improve the properties of soils with a high salt content are the examples of indirect fertilizers.

3. **Complete Fertilizers:**

These contain all the principle ingredients for the growth of plants in the combined form, so that an additional fertilizer is not necessary. Guano is an example of complete fertilizers.

Purpose of Fertilizers: They serve the following purposes:	
1.	To supplement what has been eaten up by the plants.
2.	To give an additional supply of tonic and good food, so that they may grow more healthy and produce a better yield.
3.	They help to maintain the pH value of the soil in the vicinity of 7 to 8 and thereby facilitate optimum growth and health.

4. Incomplete Fertilizers:

These fertilizers contain only one or two needed elements such as ammonium phosphate or potassium nitrate. They supply only a part of the requirements.

5. Mixed Fertilizers:

Fertilizers containing several ingredients and obtained by mechanical mixing of various fertilizers are known as mixed fertilizers.

6. Micro Fertilizers:

These contain the elements boron, manganese, zinc and copper needed in very small amounts to stimulate the plant growth.

FERTILIZERS CONTRIBUTE TO WATER POLLUTION

Farmers across the world spread millions of tonnes of fertilizers on their land each year. This provides plants with the essential elements they need to grow well, such as nitrogen from ammonium nitrate fertilizer. These fertilizers must be soluble in water so that plants can draw up the nutrients through their roots. However, because it is soluble, the fertilizer can be washed from the soil in heavy rain. We say that it is leached out of the soil.

These fertilizers drain from groundwater into rivers and streams. Once in a river, the fertilizer promotes rapid growth of algae (a tiny plant), on the surface of the water. This stops light reaching other water plants, and also reduces the amount of dissolved oxygen in the water. Fish rely on this dissolved oxygen; without it, they die.

Of course, plants produce oxygen when they photosynthesize. So, levels of dissolved oxygen increases as the plants increases. The algae thrive at first, but when they die, microorganisms have a feast feeding on and decomposing the dead algae. The microorganisms multiply rapidly with so much food available, and their activity uses up the oxygen in the water — unfortunately for the fish.

Fertilizers can also find their way into our drinking water. Fertilizers may cause stomach cancers and other harmful diseases.

ROLE OF POTASSIUM IN PLANT GROWTH

Potassium (K) is not an integral part of any major plant component, but it does play a key role in a vast array of physiological processes vital to plant growth, from protein synthesis to maintenance of plant water balance. Potassium deficiency is characterized by reduced plant growth and a yellowing and/or burning of the leaf edges. Since potassium is mobile in the plant, the symptoms appear on the older leaves first. Potassium "activates" at least 60 different enzymes involved a plant growth. Potassium also neutralizes various organic anions and other compounds within the plant, helping to stabilize pH between 7 and 8. Plants depend upon K to regulate the opening and closing of stomata. The plant's transport system uses energy in the form of ATP, which are produced in the presence of K. Potassium also plays a major role in the transport of water and nutrients throughout the plant in the xylem.

ROLE OF PHOSPHORUS IN PLANT GROWTH

Phosphorus is an essential nutrient both as a part of several key plant structure compounds and as a catalyst in the conversion of numerous key biochemical reactions in plants. Phosphorus is noted especially for its role in capturing and converting the solar energy into useful plant compounds.

The phosphorus is essential for the general health and vigor of all plants. Some specific growth factors that have been associated with phosphorus are: root development, increased stalk and stem strength, improved flower formation aniseed production, more uniform and earlier crop maturity, increased nitrogen fixing capacity of legumes, improvement in crop quality and increased resistance to plant diseases.

ROLE OF NITROGEN IN PLANT GROWTH

Its presence in moderate doses is essential for plant growth and fruiting. Nitrogen is an important component of many important structural, genetic and metabolic compounds in plant cells. It is the major component of chlorophyll. Proteins contain nitrogen. Some protein act as a structural unit in plant cells while others act as enzymes, making possible many of the biochemical reactions on which life is based. Nitrogen is also present as a part of nucleoprotein, amino acids, amines, amino sugar, polypeptides and other organic compounds in plants.

PESTICIDES

Definition:

The generic name pesticide refers to any substance, organic or inorganic, used to destroy of inhibit the action of plant or animal pests. Pest is the term which is normally used for an organism which interferes in someway with man. Virtually all pesticides are toxic to man to some degree. They vary in biodegradability. The number of pesticides is numerous.

Classification:

Pesticides may be classified in two ways. A classification more commonly in use with biologists and agronomists designates the type of pest against which the pesticide is used. The classification is, therefore, used in the following terms:

Pesticides:

Insecticides:	Chemical which are used for the control of insects.
Rodenticides:	Chemicals which kill rats and mice.
Herbicides:	Chemicals which and used against weeds.
Fungicides:	Chemicals which are used against moulds and fungi.

[redacted]

Mode of Action:

Generally the symptoms of chlorinated pesticides poisoning in insects and vertebrates include loss of movement, violent tremors which if followed by convulsions and death. Organophosphate affects nervous transmission in both insects and mammals and broadly speaking this occurs largely through the inhibition of acetyl cholinesterase whose normal role is to eliminate acetylcholine formed during nervous transmission.

Pesticides may also be grouped under general classes like:

CHLORINATED COMPOUNDS		PESTICIDES			MISCELLANEOUS
		ORGANIC ESTERS			ALKYL-ERYTHROCYANATE
Cyclic	Non-Cyclic	Phosphate	Cyclopro-pane	Carbonic	Triazines
Cmordane	DOT	TEPP	Allethrin	Carbaryl	
xHaptachlor	ODOE	Ethyl pyrophos- phate	Cinerins	Irmicarb	Pyrimidines
					Tepa
Aidrin	DDD	Dimethate	Pyrethrin	Beygon	
Dieldrin	Methoxy-chlor	Malalhione		Savin	Rotenone
Endrin					
Lindane					Nephthalene
Pentach-lorophenol					Lead arsenate
p-dichloro-benzen					
Captan					

More Common Household Pests
Mosquitoes, Flies, Bedbugs, Cockroaches, Silverfish, Booklice, Cloth moths, Crickets, Carpet beetles Other

OTHER TERMS

Several terms, used in the classification of pesticides based on the mode of the action, are of interest. Some of these terms include:

Fumigants:

Chemicals used in enclosed space and which act by producing fume or vapours wi lethal properties. (Methyl bromide and ethylene dibromide).

Repellants:

Chemicals which repel the pests (Dimethyl phathalate). Mospel is a commerci example.

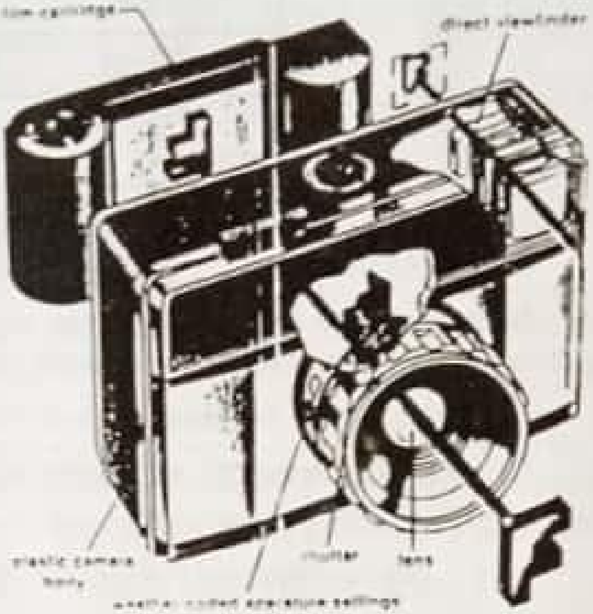
Systemics:

These are the chemicals which are absorbed by the roots or leaves of the plants and get translocated to various pails of the plants. Therefore, the whole plant becomes lethal for the target pests.

CAMERA

Introduction:

A camera is a device for producing record on sensitive material of the image of a person, object or scene formed by a lens or mirror system. The most popular type of camera records a 24×36 mm image either on black-and-white or coloured negative. The essential parts of a camera are discussed below:



Lens:

The lens or objective is the heart of the camera. It may be made up of one single element or combination of elements. The lens refracts the light that comes from an object, and focuses it as a sharp image on the fi

Shutter:

The shutter is like a small gate that opens for a very short time to let the light in, before closing again. Two types of shutter are used namely roller blind or focal plane shutters.

Aperture:

The aperture is the hole that is made when the shutter opens. A diaphragm is a device that controls the size of the aperture through which the light enters. Many cameras use an iris diaphragm mounted between the components of a lens. It consists of a set of thin metal blades mounted in ring around the lens so as to form an adjustable hole in the centre.

Viewfinder:

It consists of a wire-frame and a hole, a short distance back from it, through which the operator looks. An optical viewfinder often combined with a range finder, is essentially a small, low power telescopic device in which the image is formed so as to define the view. A third type is the reflex screen, in which the image formed by the camera objective is projected onto a ground-glass screen.

Film:

The film inside the camera is sensitive to light. It is coated with photosensitive chemicals which change their state when light shines on them. These chemicals change more quickly on some films than on others.

CAMERA Vs EYE

The construction of an eye and a camera has great similarities as shown in the following table. Unlike a photographic film, the resolving power of the photosensitive layer of the eye, the retina, is not uniform over its entire surface.

Eye	Camera
Iris	Diaphragm
Pupil	Aperture
Lens	Lens
Retina	Film

DIGITAL CAMERA

It is a camera that takes videos or still photographs via electronic image sensor. Digital cameras can do things film cameras can not:

(i) displaying images on screen immediately after they are recorded.
(ii) storing thousands of images on a single small memory device.
(iii) recording video with sound.
(iv) deleting unwanted images or videos.
(v) cropping images and pictures editing.

NANO TECHNOLOGY

NANO technology is the study of synthesis and applications of structures sized between 1 to 100 nanometers. It has led to the development of miraculous materials like clothes that do not get stained or wither off with time, shoes that do not get dirty, self cleaning glasses and anti bacterial bandages and disinfectants and LCDs.

PLASTICS

Definition:

Plastics are synthetic organic materials of high molecular weight that can be shaped in almost any form under heat. Modern age can be easily called as plastic age because almost all the articles of daily use can be made from plastics, they may be coloured or colourless. The word plastic comes from the Greek word "Plastikos" which means able to be molded. The first synthetic material was "Celluloid", a mixture of cellulose nitrate and camphor, invented in 1868. It was used as a substitute for Ivory. In 1909, a second synthetic material, "Bakelite" was invented by the Belgian-American chemist Leo Hendrik Bachisl,and by heating phenols and formaldehyde. Plastics are also called as polymeric materials, while polymer is a macromolecule formed by the chemical union of several identical units called monomers.

[redacted]

CHARACTERISTICS OF PLASTICS		LIMITATIONS OF PLASTICS
(a) Light Weight	(c) Transparent	(i) Non-resistant to heat
(b) Electrical Insulators	(d) Water Resistant	
(e) Chemical Resistant	(f) Hygienic and Non-allergenic	(ii) Non-resistant to Sunlight
	(g) Fungus Resistance	

Classification:

Plastics can be classified into the following two categories:

CLASS	DESCRIPTION	TYPICAL EXAMPLES
Thermosetting Plastics	These are those plastics which can be melted only once. After melting, they harden	Bakelite, Melamine, Silicones, Urethane Polyesters and Epoxy plastics.
Thermoplastics	These are those plastics which can be melted again and again much like the wax in a candle.	Polyethylene, Nylons, Acrylic, Polystyrene PVC, Teflon, ABS and Cellulose nitrate.

There is another household classification of plastics also; it includes soft plastics, hard plastics, transparent plastics, decorative plastics and resistant plastics, etc.

Preparation of Plastics:

The following steps are involved in making plastics. Catalysts and high pressures are used.

1.	**Molding:**	It is like making waffles.
2.	**Casting:**	It is like baking a cake.
3.	**Laminating:**	It is like making a sandwich.
4.	**Extrusion:**	It is like squeezing toothpaste.
5.	**Calendering:**	It is like spreading butter.

Uses of Plastics:

1.	Flexibility, abrasion resistance, low cost and heat stability of PVC plastic make it very popular in daily life. PVC is used for producing fils and sheets which serve the purpose of packing materials. Rigid PVC is used in pipe fittings, pump parts and chemical laboratory equipment.
2.	Polyethylene is used in making films, transparent sheets, baskets, buckets, hospital disposables, food containers and toys.
3.	Polystyrene is used in housewares, packaging, toys and wall-tiles.
4.	Polyesters are used for making clothes like Dacron, Terylene and Tetron.
5.	Teflon is used in tank and pipe lining, filter media and pump components.
6.	Epoxy plastics are used for repairing broken parts.

TEFLON:

Wonderful and Durable Plastic:

Teflon plastic is a polymer — Poly Tetra Fluoro ethylene (PTFE), which is the trade name that come from the well known DuPont Co. of France. It is the most inert plastic. It has special properties — it can neither be assimilated nor does it react with chemicals, it does not absorb anything nor does it swell. Teflon coated pans are very popular among the housewives because of its quality that nothing sticks to it. It is also very easy to clean. The Teflon coating on the pans is very thin just about 40-50 microns. At a temperature slightly above 300°C, Teflon can soften and above 400°C., it becomes a gas at this stage and can be dangerous. If the pan gets excessively heated then it gets deploymerised, meaning, that Teflon becomes tetrafluorethylene, solid gas and it gets toxic. Teflon-wares are rated as fancy, useful and modern.

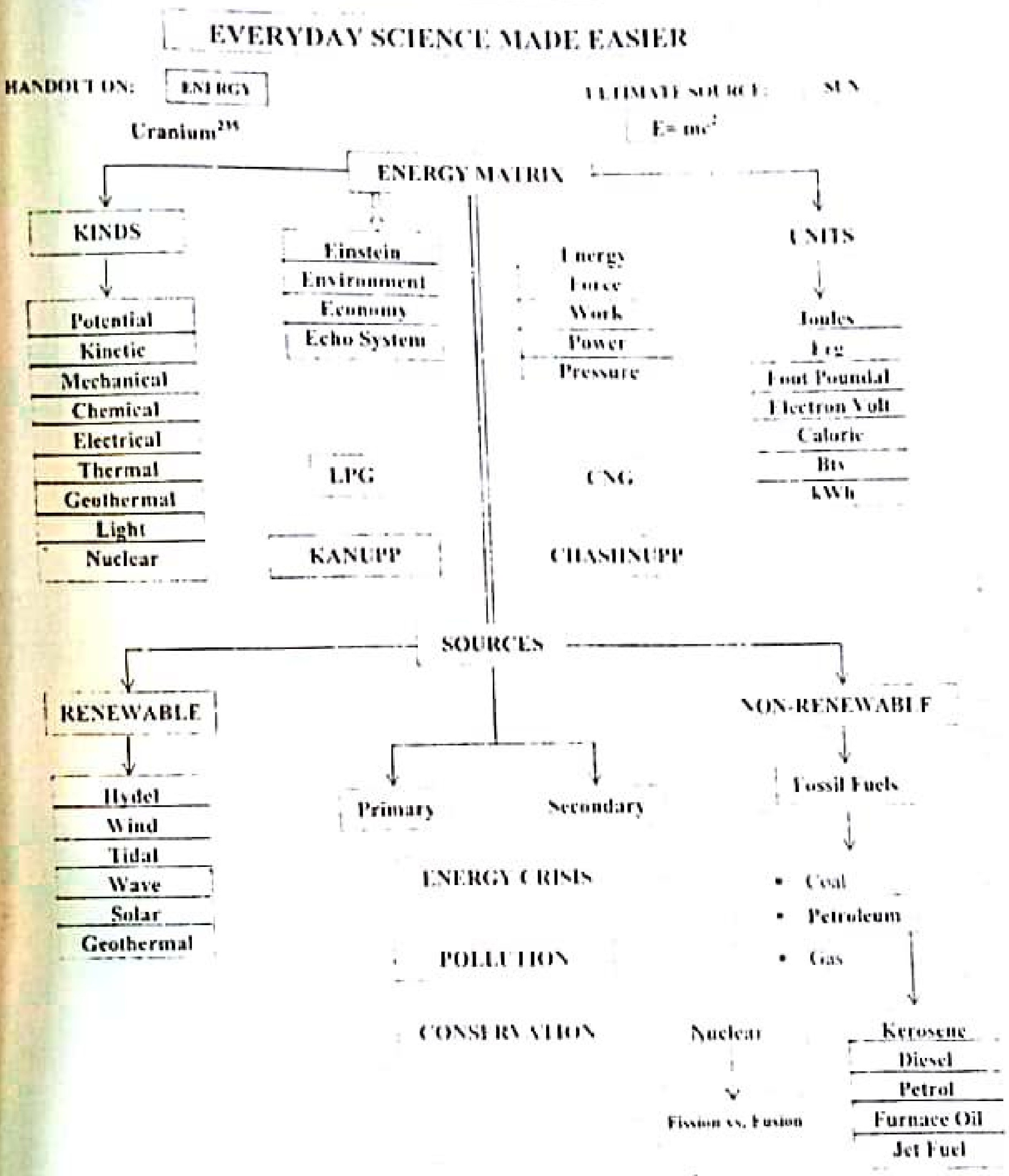
Perishable Plastics:

The basic building blocks of plastic are simple carbon based molecules known as monomers, derived from natural gas and coal. With the help of catalysts we connect monomers to form long molecular chains, known as polymers. There are about 60,000 different plastics struggling for a place in the market. The biggest problem with them is their proper disposal because of their non biodegradability, but recently perishable plastics have been made. This new plastic, called polyhydroxy-butyrate-valerate, is produced by a naturally occurring bacteria. These bacteria convert glucose to PHBV, which they store much as humans store fats. The material can be degraded in aerobic conditions to water, carbon dioxide, and humus by naturally occurring bacteria and fungi. This plastic has durability, stability and is water resistant comparable to conventional thermoplastics. Commercialization of this product will help solve the garbage mess.

Conducting plastics:

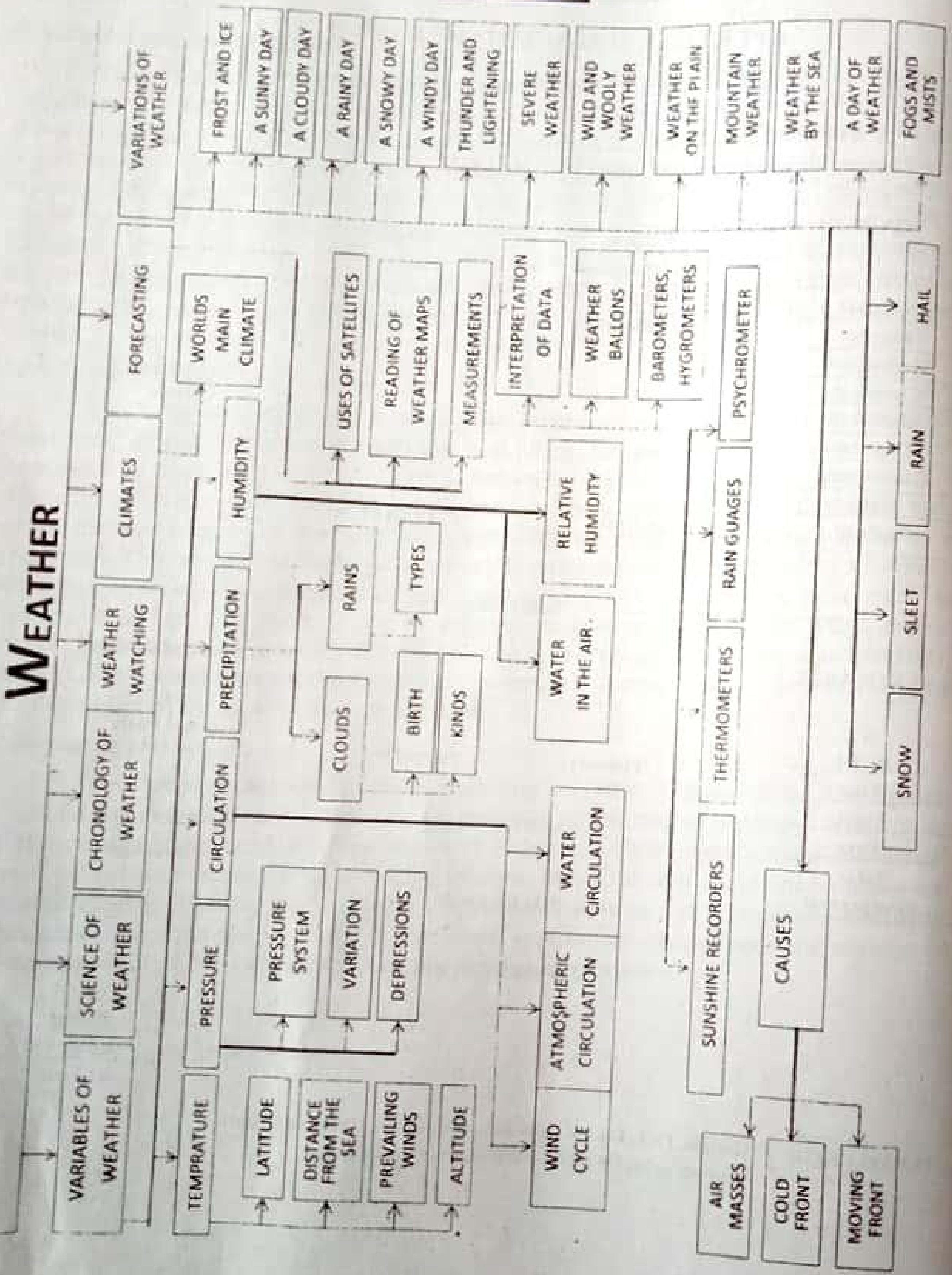
These are more accurately called conducting polymers. A theme in the development of conducting polymers has been chemists ingeniously capitalizing on mistakes. While trying to make ordinary polyacetylene in a laboratory in Japan, a worker accidentally added 1000 times the usual amount of polymerization catalyst. Instead of typical plastic, a shiny and metallic looking material was produced. Experiments showed that it conducts electricity. Conducting polymers have made few commercial applications such as antistatic coatings on photographic films, light emitting diodes and paper-thin televisions.

MCONCEPT MAP

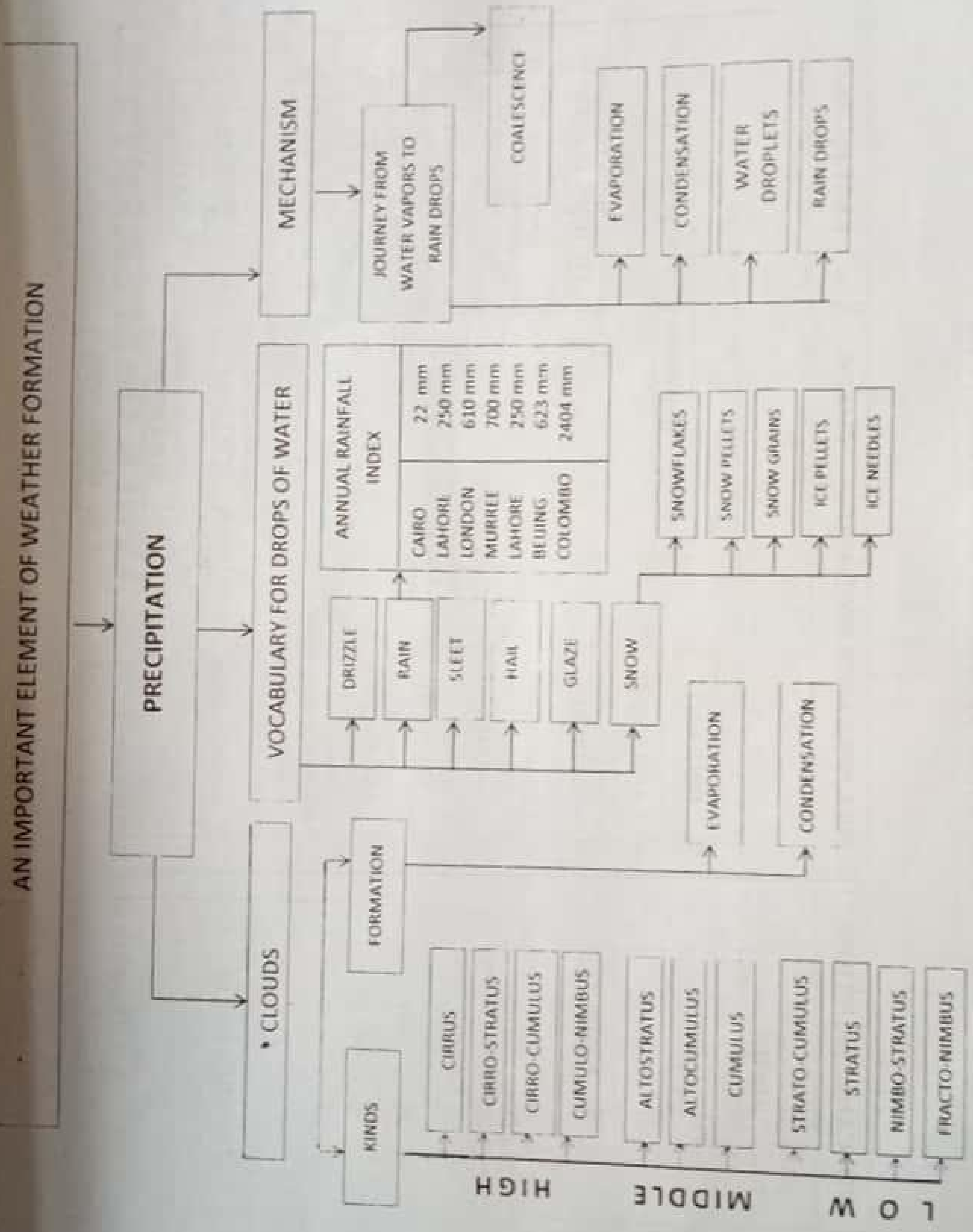


TERMS USED: Barrels, TNT, Gashol, Acre-foot, Horse-power, Petrochemicals, seismography, OFF-Shore drilling, Synfuel, Bio-Gas

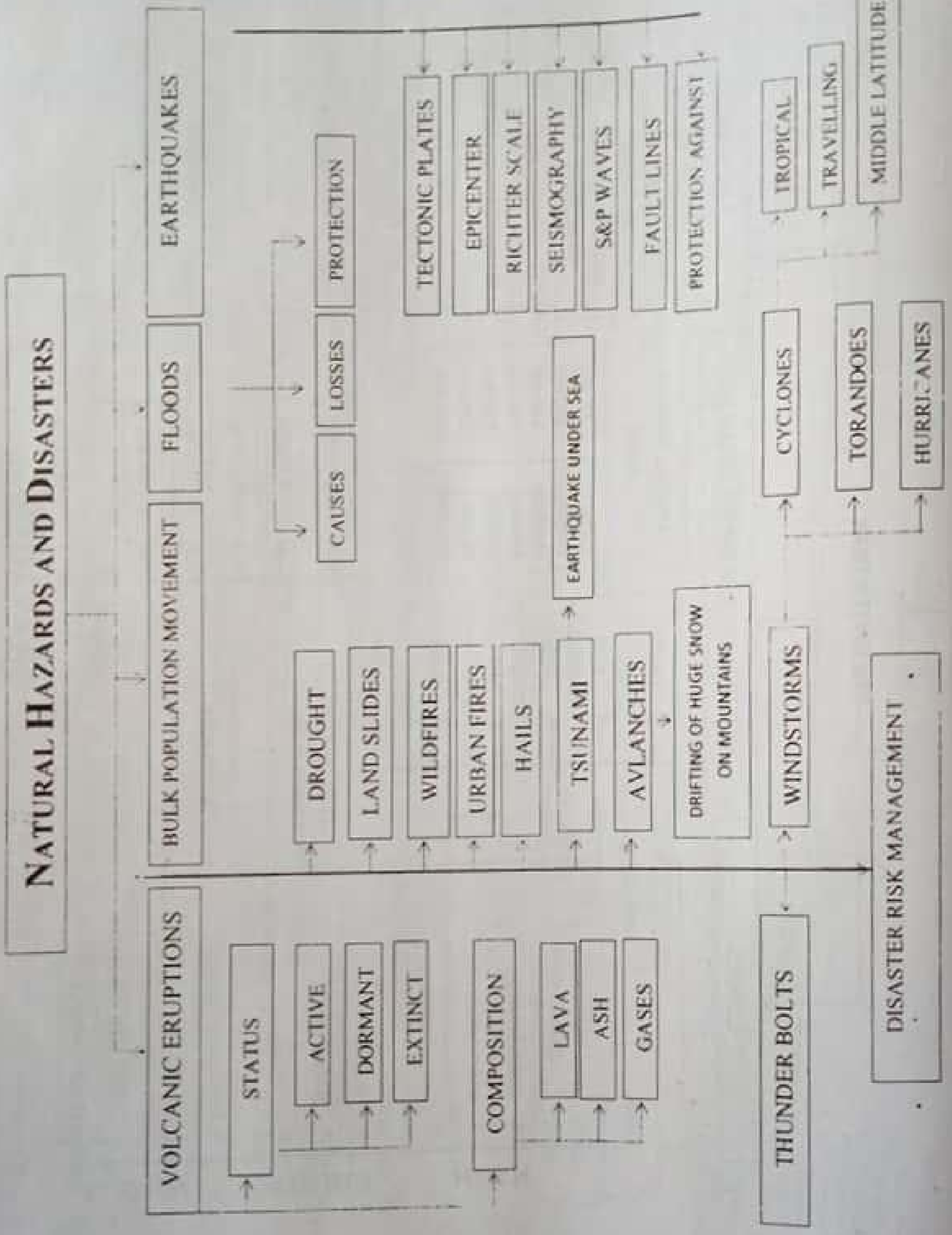
WEATHER


WEATHER
VARIABLES OF WEATHER
SCIENCE OF WEATHER
CHRONOLOGY OF WEATHER
WEATHER WATCHING
CLIMATES
FORECASTING
VARIATIONS OF WEATHER
TEMPRATURE
LATITUDE
DISTANCE FROM THE SEA
PREVAILING WINDS
ALTITUDE
PRESSURE
PRESSURE SYSTEM
VARIATION
DEPRESSIONS
CIRCULATION
WIND CYCLE
ATMOSPHERIC CIRCULATION
WATER CIRCULATION
PRECIPITATION
CLOUDS
BIRTH
KINDS
RAINS
TYPES
HUMIDITY
WATER IN THE AIR
RELATIVE HUMIDITY
WORLDS MAIN CLIMATE
USES OF SATELLITES
READING OF WEATHER MAPS
MEASUREMENTS
INTERPRETATION OF DATA
WEATHER BALLONS
BAROMETERS, HYGROMETERS
PSYCHROMETER
RAIN GUAGES
THERMOMETERS
SUNSHINE RECORDERS
CAUSES
AIR MASSES
COLD FRONT
MOVING FRONT
SNOW
SLEET
RAIN
HAIL
FROST AND ICE
A SUNNY DAY
A CLOUDY DAY
A RAINY DAY
A SNOWY DAY
A WINDY DAY
THUNDER AND LIGHTENING
SEVERE WEATHER
WILD AND WOOLY WEATHER
WEATHER ON THE PLAIN
MOUNTAIN WEATHER
WEATHER BY THE SEA
A DAY OF WEATHER
FOGS AND MISTS

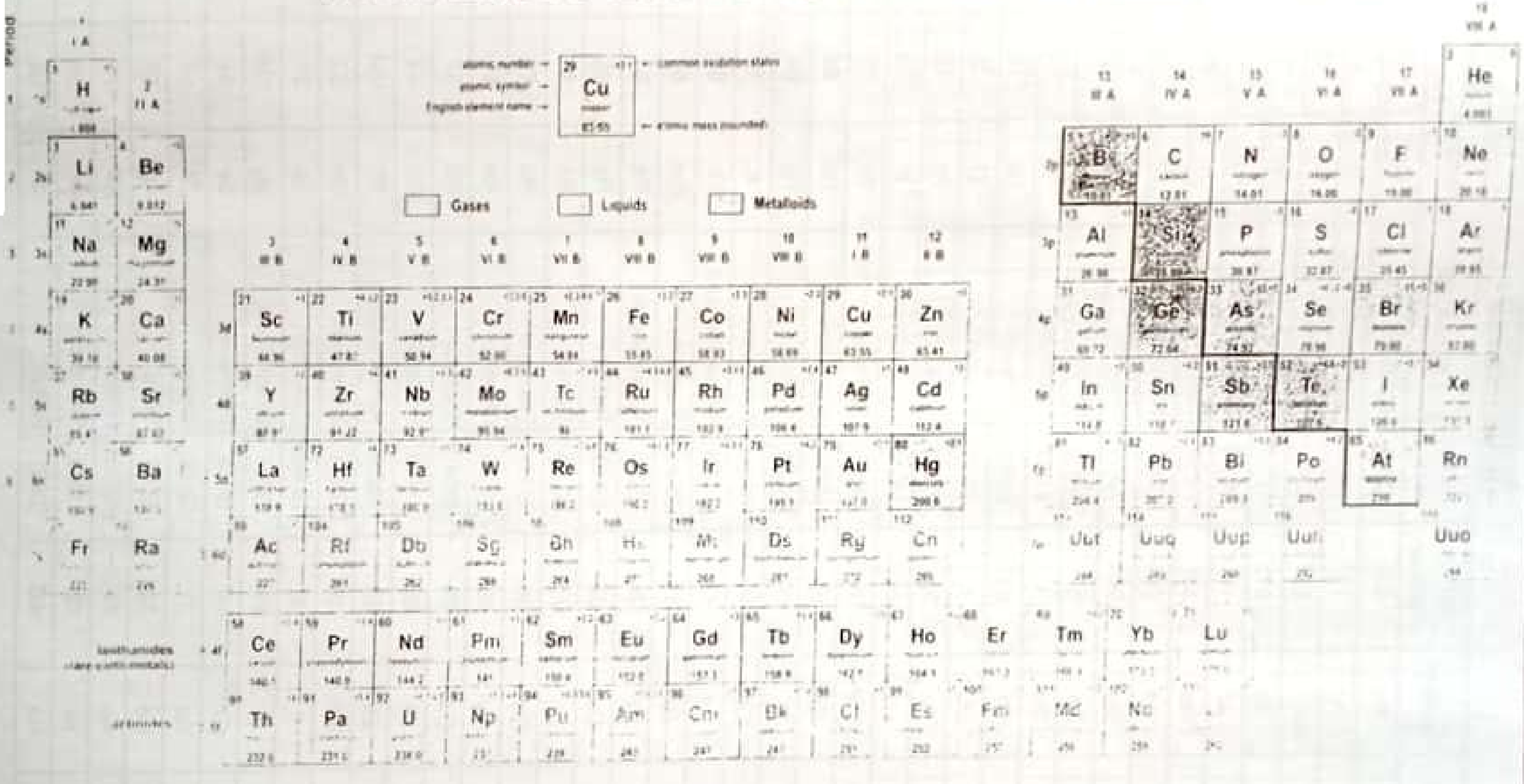
AN IMPORTANT ELEMENT OF WEATHER FORMATION



NATURAL HAZARDS AND DISASTERS



MODERN PERIODIC TABLE OF ELEMENTS



Period
atomic number
atomic symbol
English element name
common oxidation states
atomic mass (rounded)
29
Cu
63.55
Gases
Liquids
Metalloids
lanthanides (rare earth metals)
actinides

Period	1 I A	2 II A	3 III B	4 IV B	5 V B	6 VI B	7 VII B	8 VIII B	9 VIII B	10 VIII B	11 I B	12 II B	13 III A	14 IV A	15 V A	16 VI A	17 VII A	18 VIII A
1	H																	He
2	Li	Be											B	C	N	O	F	Ne
3	Na	Mg											Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Uut	Uuq	Uup	Uuh		Uuo

lanthanides (rare earth metals)	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
actinides	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	[illegible]

ELEMENTS

ELEMENT	Symbol	Atomic Number	Atomic Mass*	ELEMENT	Symbol	Atomic Number	Atomic Mass*
Actinium	Ac	89	(227)	Mercury	Hg	80	200.6
Aluminum	Al	13	26.98	Molybdenum	Mo	43	95.94
Americium	Am	95	(243)	Neodymium	Nd	60	144.2
Antimony	Sb	51	121.8	Neon	Ne	10	20.18
Argon	Ar	18	39.95	Neptunium	Np	93	(244)
Arsenic	As	33	74.92	Nickel	Ni	28	58.70
Astatine	At	85	(210)	Nielsbohrium	Ns	107	(262)
Barium	Ba	56	137.3	Niobium	Nb	41	92.91
Berkelium	Bk	97	(247)	Nitrogen	N	7	14.01
Beryllium	Be	4	9.012	Nobelium	No	102	(253)
Bismuth	Bi	83	209.0	Osmium	Os	76	190.2
Boron	B	5	10.81	Oxygen	O	8	16.00
Bromine	Br	35	79.90	Palladium	Pd	46	106.4
Cadmium	Cd	48	112.4	Phosphorus	P	15	30.97
Calcium	Ca	20	40.08	Platinum	Pt	78	195.1
Californium	Cf	98	(249)	Plutonium	Pu	94	(242)
Carbon	C	6	12.01	Polonium	Po	84	(209)
Cerium	Ce	58	140.1	Potassium	K	19	39.10
Cesium	Cs	55	132.9	Praseodymium	Pr	59	140.9
Chlorine	Cl	17	35.45	Promethium	Pm	61	(145)
Chromium	Cr	24	52.00	Protactinium	Pa	91	(231)
Cobalt	Co	27	58.93	Radium	Ra	88	(226)
Copper	Cu	29	63.55	Radon	Rn	86	(222)
Curium	Cm	96	(247)	Rhenium	Re	75	186.2
Dysprosium	Dy	66	162.5	Rhodium	Rh	45	102.9
Eiristeinium	Es	99	(254)	Rubidium	Rb	37	85.47
Erbium	Er	68	167.3	Ruthenium	Ru	44	101.1
Europium	Eu	63	152.0	Rutherfordium	Rf	104	(261)
Fermium	Fm	100	(253)	Samarium	Sm	62	150.4
Fluorine	F	9	19.00	Scandium	Sc	21	44.96
Francium	Fr	87	(223)	Seaborgium	Sg	106	(266)
Gadolinium	Gd	64	157.3	Selenium	Se	34	78.96
Gallium	Ga	31	69.72	Silicon	Si	14	28.09
Germanium	Ge	32	72.59	Silver	Ag	47	107.9
Gold	Au	79	197.0	Sodium	Na	11	22.99
Hafnium	Hf	72	178.5	Strontium	Sr	38	87.62
Hahnium**	Ha	105	(262)	Sulfur	S	16	32.07

Hassium	Hs	108	(265)	Tantalum	Ta	73	180.9
Helium	He	2	4.003	Technetium	Tc	43	(98)
Holmium	Ho	67	164.9	Tellurium	Te	52	127.6
Hydrogen	H	1	1.008	Terbiurfi	Tb	65	158.9
Indium	In	49	114.8	Thallium	Tl	81	204.4
Iodine	I	53	126.9	Thorium	Th	90	232.0
Iridium	Fr	77	192.2	Thulium	Tm	69	168.9
Iron	Fe	26	55.85	Tin	Sn	50	118.7
Krypton	Kr	36	83.80	Titanium	Ti	22	47.90
Lanthanum	La	57	138.9	Tungsten	W	74	183.9
Lawrencium	Lr	103	(257)	Uranium	U	92	238.0
Lead	Pb	82	207.2	Vanadium	V	23	50.94
Lithium	Li	3	6.941	Xenon	Xe	54	131.3
Lutetium	Lu	71	175.0	Ytterbium	Yb	70	173.0
Magnesium	Mg	12	24.31	Yttrium	Y	39	88.91
Manganese	Mn	25	54.94	Zinc	Zn	30	65.39
Meitnerium	MI	109	(266)	Zirconufm	Zr	40	91.22
Mendelevium	Md	101	(256)				

*All atomic masses are given to four significant figures. Values in parentheses represent the mass number of the most stable isotope.

**The names and symbols given here for elements 104 through 109 are those recommended by their discoverers. Final agreement on the names has not been reached.

MULTIPLE CHOICE QUESTIONS

1. Neil. A. Armstrong visited the moon on July 16, 1969 and remained there f hours and 36 minutes. Name the manned spacecraft which took him on this miss

(a) U.S. Gemini 12 (b) USSR Soyuz 5

[✓ (c) U.S. Apollo 11] (d) U.S. Apollo 9

2. 'Early Bird' was the first operational communication satellite launched int Earth's orbit by NASA. When was it launched?

(a) 1920 [✓ (b) 1965]

(c) 1945 (d) 1975

3. Comets are bodies that move around the sun, most of them in highly elliptic o Name the famous comet which visited our Earth in 1986 and will return in the 2062.

(a) Pons-brooks [✓ (b) Halley]

(c) Crommelin (d) Neujmin 1.

4. Over the next two decades, NASA plans to launch more than two dozens satellit its "Mission to Planet Earth". The eyes in the sky will collect information clouds; ocean circulation, ice and pollution, helping scientists refine their predic of global warming. What does NASA stand, for?

(a) Nuclear Atlantic Supervisory Agency.

(b) Nuclear Agency for Space Administration.

[✓ (c) National Aeronauties and Space Administration]

(d) None of them

5. How much time the light takes to reach from the Sun to the Earth?

(a) Four minutes and 30 seconds

[✓ (b) Eight minutes and 15 seconds]

(c) Seven minutes and 15 seconds

(d) Six minutes and 30 seconds

6. Astronomical unit is a bigger unit of distance and it is used to measure dista between the heavenly bodies of the solar system. One astronomical unit is equ how much Km in whole numbers?

(a) 50 million Km. (b) 100 million Km.

[✓ (c) 150 million Km.] (d) One million Km.

7. Light year is still even a bigger unit of distance. It is defined as the distance trav by light in one year. This unit is used to measure distances between the gala How much is one light year approximately equal to:

(a) One hundred million Km. (b) Ten million Km.

(c) Ten thousand million Km. [✓ (d) Ten million million Km.]

8. How many stars are present in our Milky Way galaxy?

[✓ (a) 10^{11}] (b) 10^{2}

(c) 10^{5} (d) 10^{3}

9. What is the shape of our Milky Way galaxy?

(a) Irregular (b) Spiral

(c) Elliptic (d) Rectangular

10. The celebrated rings of giant Saturn are composed of thousands of rippling, spiraling bands from 6 to 60 miles in width. Which other planet of our solar system also has rings?

(a) Venus (b) Mercury

(c) Neptune (d) Jupiter

11. Name the brightest planet of our solar system.

(a) Jupiter (b) Venus

(c) Mars (d) Mercury

12. Name the smallest planet of our solar system.

(a) Pluto (b) Mars

(c) Mercury (d) Neptune

13. Space Shuttle Challenger (on Mission 51-L) exploded into fireball in which seven space heroes were burnt to ashes. The explosion of fuel in the external tank destroyed the spacecraft 70 seconds after the lift-off from the Kennedy Space Center in Florida. When did this tragic incident occur?

(a) December 28, 1986. (b) January 28, 1986.

(c) December 28, 1985 (d) February 28, 1985.

14. Name the largest planet of our solar system.

(a) Saturn (b) Jupiter

(c) Venus (d) Neptune.

15. Black hole is a hypothetical region in space having tremendously high gravitational pull. Which one of the following also refers to black holes?

(a) Holes occurring in heavenly bodies.

(b) Black spots on the Sun.

(c) Collapsing object of very high density.

(d) Craters on the moon.

16. Which planet of our solar system has the highest density or is the densest.

(a) Earth (b) Pluto

(c) Jupiter (d) Venus

17. Red shift experiments have shown that the Universe is expanding.Name the scientist who first provided evidence for the expansion of the Universe.

(a) William Muggins (b) Edwin P. Hubbel.

(c) Henry Russel (d) George Gamow.

18. Which planet of our solar system has maximum number of moons?

(a) Saturn (b) Jupiter

(c) Venus (d) Earth.

19. Which planet of our solar system takes 687 days to go once around the Sun?

(a) Mercury (b) Pluto

[✓ (c) Mars] (d) Neptune.

20. Name the nearest regular galaxy to our Milky Way.
(a) NGC185 (b) Small Magellanic Cloud.
(c) Large Magellanic Cloud [✓ (d) Andromeda.]

21. Name the nearest star to our sun.
[✓ (a) Proxima Centurai] (b) Alpha Scorpii
(c) Beta Orionis (d) Vega

22. Which planet of our solar system is the fastest in rotation?
(a) Mars (b) Pluto
[✓ (c) Jupiter] (d) Venus.

23. Reflecting telescope and Gregorian telescope were respectively invented by Isaac Newton and James Gregory. Who invented the infrared telescope?
[✓ (a) Frank Low] (b) David Gregory
(c) David Alien (d) Langley.

24. Name the closest planet to the Sun.
(a) Mars (b) Mercury
(c) Pluto [✓ (d) Jupiter]

25. Name the farthest away planet from the Sun.
(a) Neptune [✓ (b) Pluto]
(c) Mercury (d) Mars

26. Length of days is different for different planets of the solar system. A day on Venus is 117 Earth days long. How many Earth days would be equal to one day on Mercury?
(a) 30 days (b) 40 days
(c) 50 days [✓ (d) 55 days]

27. Name the third planet from the sun.
[✓ (a) Earth] (b) Jupiter
(c) Venus (d) Saturn

28. Name the year in which spacecrafts Viking I and Viking II landed on Mars.
(a) 1973 (b) 1974
(c) 1975 [✓ (d) 1976]

29. Mars is a barren desert. It is covered with red dust, which is why Mars is also called as the:
[✓ (a) Red planet] (b) Brown planet
(c) Hot planet (d) Cold planet

30. Name the large gas giant planet which is larger than all of the other planets put together.
(a) Neptune (b) Saturn
[✓ (c) Jupiter] (d) Venus.

[redacted]

31. Jupiter is the fifth planet from the Sun. It is named after the greatest of the Roman gods. It is much bigger than Earth. About how many Earths would equal to one Jupiter?

(a) 100
(b) 500
(c) 700
[✓ (d) 1000]

32. Name the planet which was last discovered?

[✓ (a) Pluto]
(b) Neptune
(c) Uranus
(d) Venus.

33. Although Neptune is the eighth planet of the solar system and Pluto the ninth. But Pluto has a lopsided orbit around the Sun. In the late 1970s, it moved closer to the Sun than Neptune. Pluto is now the eighth planet and Neptune is the ninth. In which year, Pluto will once again become the ninth planet?

[✓ (a) 1999]
(b) 1997
(c) 1998
(d) 1995

34. What is the distance of the Moon from the Earth?

(a) 340,000 Km.
[✓ (b) 385,000 Km.]
(c) 380,000 Km.
(d) 360,000 Km.

35. Name the largest moon in our solar system.

[✓ (a) Ganymede]
(b) Titan
(c) Callisto
(d) Miranda.

36. Which planet of our solar system has the largest moon?

(a) Uranus
(b) Neptune
(c) Saturn
[✓ (d) Jupiter]

37. Miranda, Ariel, Umbriel, Titania and Oberon are the five largest moons of a planet. Name the planet:

(a) Jupiter
[✓ (b) Uranus]
(c) Venus
(d) Saturn.

38. Name the biggest Asteroid of the solar system

[✓ (a) Ceres]
(b) Hermes
(c) Icarus
(d) Hidalgo

39. How far away is the Andromeda Galaxy from our Milky Way?

(a) One million light years.
[✓ (b) Two million light years.]
(c) Two thousand light years.
(d) Hundred thousand light years.

40. There are millions of galaxies in the Universe. A group of galaxies is called galactic clusters. What is the name of a small cluster to which our Milky Way belongs to?

[✓ (a) Local group]
(b) Zero group
(c) Large group
(d) Small group.

41. In February 1987, astronomers in South America discovered a supernova explosion in the Large Magellanic Cloud, a small galaxy not far from the Milky way. The explosion, which was visible to the naked eye for several weeks. It was the closest supernova that astronomers have observed in nearly 400 years. How many years ago, the actual explosion must have taken place?

(a) 140,000 years ago (b) 150,000 years ago
(c) 160,000 years ago [✓ (d) 170,000 years ago]

42. English names of the days of the week are derived from the names of the heavenly bodies or from the names of gods. Sunday is named after the Sun and Monday after the Moon. How is the name of Friday derived?
(a) Tiw, the Anglo-Saxon counterpart of the Nordic god Tyr.
(b) Thor, the Nordic god of thunder.
[✓ (c) Frigg. the Nordic goddess of Love.]
(d) Saturn, Roman god of agriculture and vegetation.

43. Comets can best be described as dirty snowballls. They are thought to originate in a region known as the Oort Cloud, about one light year away from the Sun. Halley's comet is the best known example. What is the period of Halley's comet?
(a) 60 years (b) 70 years
[✓ (c) 76 years] (d) 80 years.

44. The majority of stars are members of binary or multiple star systems. Binary stars consist of two stars each orbiting around their common center of gravity. Which eclipsing binary star was first discovered?
[✓ (a) Algol] (b) Beta Lyrae
(c) Epsilon Aurigae (d) Castor

45. Radio telescope is different from optical telescope. Instead of seeing, it detects the radio signals. Who was the first to build a radio telescope?
(a) Bernard Lovell [✓ (b) Karl Jansky]
(c) Van de Hulst (d) John Flamsteed.

46. Formation of Eclipses is the manifestation of what property of light?
(a) Polychromatic nature of light. [✓ (b) Rectilinear Propagation of light.]
(c) High velocity of light. (d) Reflection of light.

47. At the time of the occurrence of the total solar eclipse, what is the phase of the moon?
(a) Full moon [✓ (b) New moon]
(c) First quarter (d) Waning globous.

48. Why is the total solar eclipse of July 11, 1991, called the Eclipse of the Century.
(a) Because it was seen from all parts of the world.
[✓ (b) Because it lasted for about seven minutes.]
(c) Because it was the most mysterious eclipse.
(d) Because it occurred 500 years after.

49. Comets have always seemed to frighten people and considered as omens of disasters. But now these are cosmic visitors for us. When was famous Halley's comet first seen?
[✓ (a) 1456] (b) 1531
(c) 1607 (d) 1682

50. When did Edmund Halley calculate the orbit of Hal ley's comet?
[✓ (a) 1705] (b) 1725

(c) 1745
(d) 1758.

51. It is blue, beautiful and on the edge of the solar system. After 12 years and 4.43 billion miles, Voyager 2 reached there. It is also called baby-blue planet. Name the planet:

[✓ (a) Neptune]
(b) Venus
(c) Saturn
(c) Jupiter.

52. About 4,100 years ago, a Neolithic people built a remarkable monument, called the Stonehenge. It was actually an astronomical clock and they could predict eclipses, the exact days of the solastices, the long term cycles of the Moon and Sun and other important heavenly events. In which country is Stonehenge situated?

(a) Australia
(b) China
(c) Pakistan
[✓ (d) England.]

53. Name the coldest planet of our solar system.

(a) Mars
(b) Mercury
[✓ (c) Pluto]
(d) Neptune.

54. Launched by NASA in spring 1990, the Hubble space Telescope is the greatest scientific achievement of the 20th century. It will probe the Universe as it existed 15 billion years ago. About how many miles above the surface of the Earth, it is orbiting?

[✓ (a) 380 miles]
(b) 100 miles
(c) 200 miles
(d) 300 miles

55. Name the planet which has no moon.

(a) Pluto
(c) Mars
[✓ (b) Mercury]
(d) Jupiter

56. Radio astronomy began in 1931 when a young radio engineer for Bell Telephone Laboratories, began seeking the source of static that interfered with transatlantic communication. Name him.

[✓ (a) Karl Jansky]
(b) Robert Wilson
(c) Rober Dick
(d) Arno A. Penzias.

57. The first confirmed meteorite crater on Earth was identified in the Arizona desert between Flagstaff and Winslow in 1904 by David Moreau Barringer. What is the width of this Barringer Meteorite Crater?

(a) 40 feet
(b) 100 feet
(c) 400 feet
[✓ (d) 4000 feet.]

58. The sky looks blue from the surface of the Earth and it looks black from the moon which has no atmosphere. It appears orangish red from the plains of Mars which is surrounded by thin air of carbon dioxide. These different patterns of colour in the air are due to:

(a) Presence of water vapours
[✓ (b) Scattering of white light of the Sun.]
(c) Visual illusions
(d) Radio waves.

59. The Aurora or Northern Polar lights are among the most interesting phenomenon visible on the Earth. The display commences with a greenish-white light arcing from

horizon to horizon across the apex of the sky. The electromagnetic bands that generate the aurora are in which part of the atmosphere.

(a) Ionosphere
[✓ (b) Thermosphere]
(c) Stratosphere
(d) Mesophere

60. Physicists have known about these high energy invisible rays for 80 years, but their precise nature is still a mystery. They come from unknown parts. They pack a mean energy. And they seem to break the laws of physics. Name them

(a) X-rays
(b) UV-rays
(c) Visible rays
[✓ (d) Cosmic rays.]

61. Faster than a speeding bullet, more powerful than a supernova, able to crush small planets with a single swipe — these are primordial, angel-hair thin cracks in the structure of the space. Name them.

[✓ (a) Cosmic strings]
(b) Saturn rings
(c) Newton's rings
(d) Black holes.

62. When Pakistan launched its second telecommunication satellite Badar 'B'?

(a) In 1996
(b) In 1997
[✓ (c) In 1995]
(d) In 1998.

63. Atmosphere of the Earth is made up of different spheres. In which part of the atmosphere commercial aircrafts usually fly?

(a) Thermosphere
(b) Stratosphere
[✓ (c) Troposphere]
(d) Mesosphere.

64. Why do we see but only one face of the Moon always?

(a) Because the Moon has phases.
(b) Because the Moon is not spinning around it axis.
(c) Because it is in between the Sun and the Earth.
[✓ (d) Because it has synchronous revolution and spin.]

65. The Sun rises on the North Pole on the 21st March and this pole remains in light till what date?

[✓ (a) 23rd September]
(b) 21st September
(c) 22nd June
(d) 22nd December.

66. What was the approximate temperature of the Universe at the time of its birth?

[✓ (a) 10^{28}°C]
(c) 10^{20}°C
(b) 10^{10}°C
(d) 10^{5}°C.

67. Name the gas which was discovered on the Sun about 125 years ago during eclipse watching.

(a) Hydrogen
[✓ (b) Helium]
(c) Nitrogen
(d) Argon.

68. After how much time, a total solar eclipse passes over a particular spot on the Earth.?

(a) 100 years after
(b) 200 years after
(c) 250 years after
[✓ (d) 360 years after.]

69. About how much energy is radiated per square meter of Sun's surface into space?
(a) 64 thousand watts (b) 64 hundred watts
(c) 64 hundred thousand watts [✓ (d)] 64 million watts.

70. What is the approximate age of the Sun?
(a) 6.4 thousand years [✓ (b)] 6.4 billion years
(c) 6.4 million years (d) 6.4 hundred thousand years.

71. How many times is Jupiter's gravity greater than that of the Earth?
(a) 64 times (b) 164 times
[✓ (c)] 264 times (d) 364 times

72. About how many years ago, the first solar eclipse was officially recorded by man?
(a) 1,000 years (b) 2,000 years
(c) 3,000 years [✓ (d)] 4,000 years.

73. What is the maximum possible duration of a total solar eclipse?
(a) 3 minutes and 30 seconds [✓ (b)] 7 minutes and 20 seconds
(c) 6 minutes and 30 seconds (d) 5 minutes and 20 seconds.

74. Why a solar eclipse cannot be seen from all parts of the world?
[✓ (a)] Because it depends upon the latitude of the observer.
(b) Because it depends upon the direction of the wind.
(c) Because it depends upon the speed of the Earth.
✗ (d) None of the above.

75. The equator of the moon is inclined 6 degrees to the plane of its orbit around the Earth — therefore 100 percent of the moon's surface is not visible at different times from the Earth. What percentage of moon's surface is visible?
(a) 59% (b) 49%
(c) 39% [✓ (d)] 69%

76. The interval between two total solar eclipses is called the Saros cycle What is its duration?
(a) 6 years (b) 10 years
[✓ (c)] 18 years (d) 11 years

77. The Moon moves Eastward in its orbit at about 3400 km per hour. Approximately what is the speed of rotation of the Earth at its equator?
(a) 700 km per hour [✓ (b)] 1700 km per hour
(c) 2700 km per hour (d) 3700 km per hour.

78. How many maximum number of solar eclipses can occur in one calendar year?
[✓ (a)] Seven (b) Five
(c) Four (d) One

79. Name the instrument which is used to measure the speed of an aircraft relative to the speed of sound.
(a) Speedometer (b) Altimeter
(c) Telemeter [✓ (d)] Machmeter.

[redacted]

80. A layer of Ozone in the stratosphere protects the Earth by blocking most of the Sun's harmful ultraviolet light. These are high energy radiations. Which of the following can have the potential effects of UV light.

(a) Eyes (b) Skin
(c) Crops (d) All the above.

81. Nebula is a cloudy luminous patch in the heavens that consists of a galaxy of stars or of materials (dust and gas) from which such galaxies are being formed. Name the brightest Nebula in the sky.

(a) Large Magellanic Cloud (b) Orion Nebula
(c) Ring Nebula (d) M 42

82. No spectacle in the Universe is more dramatic than an exploding star. What name is given to this phenomenon in cosmology?

(a) Black hole (c) Neutron Star
(b) Supernova (d) None of the above.

83. Titan is the moon of a planet of our solar system, it is loaded with organic substances that bacteria can eat. Name the planet.

(a) Venus (b) Neptune
(c) Saturn (d) Jupiter

84. "God does not play dice with the Universe" who said this?

(a) Albert Einstein (b) Edmund Halley
(c) Edwin Rubble (d) Francis Daily.

85. Quasars are recently discovered extra-galactic sources of high energy electromagnetic radiation. Name the brightest Quasar known.

(a) 3 C-245 (b) 3 C-273
(c) 0Q-172 (d) PK-220-330

86. Which one of the following is not the name of the space shuttles?

(a) Challenger (b) Atlantis
(c) Columbia (d) Skylab.

87. Stars are self-luminous heavenly bodies. Name the star which is the brightest in the night sky.

(a) Canopus (b) Spica
(c) Regulus (d) Sirius.

88. Constellation is the configuration of a group of stars. Hydra is the largest constellation. Name the smallest constellation.

(a) Cetus (b) Crux Australis
(c) Apus (d) Dorado

89. Planets are non-luminous heavenly bodies may be rocky or gaseous. But some planets enjoy the status of a star in everyday life. Which planet of our solar system is called as the Morning Star?

(a) Mars (b) Mercury
(c) Uranus (d) Venus

90. Satellites are objects that revolve around planets. Satellites may be natural (like moons) or artificial (man-made). Man-made satellites are launched into the Earth's orbit for various purposes. Which one of the following man-made satellite goes round the Earth at low altitudes?

(a) Meteorological Satellites. (b) Communication Satellites.
(c) Spy Satellites (d) Navigation Satellites.

91. Meteorites are extra-terrestrial intruders and they have been hitting our Earth in the past. A huge meteorite fell in Juguska, Siberia (Russia) in the early twentieth century. What was the year?

(a) 1908 (b) 1907
(c) 1906 (d) 1901.

92. Who was the first to show that the planets move around the Sun in elliptic orbits?

(a) Ptolemy (b) Johannes Kepler
(c) Archimedes (d) Galilio Galilei.

93. Penzias and Wilson detected an Echo from the Big Bang in the form of microwave radiation. This is also called as the 3 K microwave background signal. In which year were Penzias and Wilson awarded the Nobel Prize for this discovery?

(a) 1978 (b) 1968
(c) 1958 (d) 1948

94. So like the Sun in chemical composition, the lord of the planets falls far short of the bulk and heat to blaze as a star itself. It is the hottest planet of our solar system. Name it.

(a) Neptune (b) Saturn
(c) Jupiter (d) Uranus.

95. Proxima Centauri is the nearest star to the Earth apart from the Sun. How far is this from the Earth?

(a) 8.22 light years. (b) 7.22 light years
(c) 6.22 light years. (d) 4.22 light years.

96. Parsec is a unit of distance used to measure the separation of stars. What is its equivalent in light years?

(a) 3.26 light years (b) 4.26 light years
(c) 5.26 light years (d) 6.26 light years.

97. Zodiac is the zone of the celestial sphere that contains the paths of the sun, the moon and the planets. How many constellations lie on the Zodiac belt?

(a) 12 (b) 14
(c) 16 (d) 18

98. Polaris is the northern pole star. Name the southern pole star.

(a) Ursae (b) Sigma Octanis
(c) Tau Octanis (d) Lambda Octanis

99. Stars are of various types. Our Sun is also a typical star. What type of star it is is?

(a) Supergrant (b) Red giant
(c)• Yellow dwarf (d) White dwarf.

[redacted]

100. Matter of the Universe exists in four distinct physical states. Name the physical state in which most of the matter of the Universe is conserved.
(a) Liquid (b) Solid
(c) Gas [✓ (d) Plasma.]

101. "Geography as a whole is regarded as that department of knowledge which studies the varied features of the Earth's surface as the environment of mankind". It is one of the oldest disciplines and has been defined by different people in different ways over the years. Geography is a branch of which of the following faculties?
(a) Physical Sciences (b) Chemical Sciences
(c) Biological Sciences (d) Social Sciences.

102. "Geography is Human Ecology". This is another characteristic definition of geography. Name the author of this definition.
(a) Marthe (b) Taylor
(c) Spykman (d) Barrows

103. Below are given some more definitions of geography alongwith their authors. Which of the following is a wrong pair?
(a) Geography is the science of places; ________ Vidal de al Blache.
(b) Geography is the science of distribution; ________ Marthe.
(c) Geography is the strategy of men, space and resources; _______ Taylor.
(d) Geography tells what is where, why and what it is made of ________ Barrows.

104. Geographers of the world divide geography different branches. What is the name of the geography which deals, with the man — made features of the Earth.
(a) Physical geography, (b) Human geography
(c) Astronomical geography (d) General geography.

105. Physical geography is the study of man's life and work in relation to the environment, which of the following topics are studied under the heading of physical geography?
(a) Land forms (b) Natural vegetation
(c) Drainage forms (d) All the above.

106. Continent is a continuous mass of land. Continents make a division of land on the globe. How many continents are present on the surface of this Earth.
(a) Four (b) Five
(c) Six (d) Seven.

107. Gondwana and Laurasia were the names of two supercontinents which defined the land surface of the Earth in prehistoric times. Which of the following land surface was the essential part of Gondwana?
(a) Australia (b) Africa
(c) Pakistan (d) All the above.

108. Name the biggest continent.
(a) Africa (b) Asia
(c) Europe (d) North America.

109. Name the smallest continent,
(a) Australia (b) South America
(c) Europe (d) Antarctica

110. Name the second biggest continent.
(a) North America (b) South America
(c) Africa (d) Europe.

111. Name the continent which is completely situated in the northern hemisphere.
(a) North America (b) Asia
(c) Europe (d) Antarctica.

112. What is the approximate area of Asia?
(a) 14,129,000 square miles (b) 15,129,000 square miles
(c) 16,129,000 square miles (d) 17,129,000 square miles

113. About how much percent of world land is occupied by Asia?
(a) 26.7% (b) 27.7%
(c) 28.7% (d) 29.7%

114. Name the highest point in Asia.
(a) Mount Mckinely (b) Mount Everest
(c) Aconcagua (d) Vinson Massif.

115. Name the lowest point in Asia.
(a) Dead Sea (b) Lake Assal
(c) Caspian Sea (d) Death Valley

116. Name the highest point in North America.
(a) Kibo (b) Mount Mckinely
(c) Mount Kossciusko (d) Elbrus.

117. Name the lowest point in North America.
(a) Lake Assal (c) Caspian Sea
(b) Death Valley (d) Salinas Grandes.

118. Name the continent which has the largest area of Equatorial Rain Forest.
(a) South America (b) Asia
(c) Africa (d) Australia.

119. Name the largest ocean.
(a) Atlantic (b) Pacific
(c) Indian (d) Arctic.

120. What is the approximate area of the Pacific Ocean?
(a) 60,186,000 square miles (b) 62,186,000 square miles
(c) 63,186,000 square miles (d) 64,186,000 square miles

121. Name the biggest sea of the world.
(a) Mediterranean Sea. (b) South China Sea.
(c) North Sea. (d) Caribbean Sea.

122. What is the approximate area of the Caribbean Sea?
(a) 970,000 square miles.
(b) 960,000 square miles.
(c) 950,000 square miles.
(d) 940,000 square miles.

123. Name the longest river of the world.
(a) Amazon
(b) Nile-Kagera
(c) Yangtze
(d) Ganges.

124. Name the second largest river of the world.
(a) Yangtze
(b) Indus
(c) Volta
(d) Amazon.

125. Amazon river empties into:
(a) Pacific Ocean
(b) Atlantic Ocean
(c) Indian Ocean
(d) North Sea.

126. Nile-Kagera empties into:
(a) Mediterranean Sea
(b) Black Sea.
(c) Dead Sea
(d) North Sea.

127. Which of the following is not a great world desert?
(a) Gobi
(b) Kalahari
(c) Dasht-i-Lut
(d) Eyre.

128. Where is Sahara desert situated?
(a) Northern Africa
(b) Western Australia
(c) Iran
(d) Northern Sudan.

129. Name the famous desert of Northern Chile.
(a) Gibson
(b) Atacama
(c) Great Sandy
(d) Colorado.

130. Name the largest lake of the world.
(a) Caspian Sea
(b) Chad
(c) Baykal
(d) Kariba.

131. Name the biggest World Island.
(a) Borneo
(b) Green land
(c) Madagascar
(d) Fiji.

132. What is the exact shape of the Earth?
(a) It is like a perfect sphere.
(b) It is like a tricket ball.
(c) It is like an oblate spheroid.
(d) It is like an orange.

133. Because the Earth is not a perfect sphere therefore, its equotorial diameter is not equal to the polar diameter. About how many miles the equotorial (horizontal) diameter is bigger than the polar (vertical) diameter.
(a) 7 miles
(b) 17 miles
(c) 27 miles
(d) 37 miles.

134. What is the approximate circumference of the Earth?
(a) 25,000 miles
(b) 35,000 miles

(c) 15,000 miles (d) 10,000 miles.

135. The inferior of the Earth is divided into Crust, Mantle and Core. The crust of the Earth is also called as the skin of the Earth and is the thinnest of the three. What is the approximate thickness of the crust?

(a) 10 miles (b) 20 miles
(c) 30 miles (d) 40 miles.

136. Which of the following is not a main feature of the land surface of the Earth?

(a) Mountains (b) Plateaus
(c) Plains (d) Deeps.

137. Valleys are important features of mountains. A valley is an opening between two mountains or hills. Which of the following is not a broad valley in Pakistan?

(a) Multan (b) Gilgit
(c) Chitral (d) Kaghan.

138. Which one of the following is not a feature of coast lines?

(a) Peninsula (b) Bay
(c) Plain (d) Gulf

139. What name is given to a lake which has a sea bar at least on one side?

(a) Island (b) Lagoon
(c) Isthmus (d) Strait

140. Mountains are covered with snow. When snow becomes old and is pressed hard, it is called ice. Ice also flows down the slopes like rivers. These rivers of ice are called Glaciers. Which of the following is not the name of glaciers in Pakistan.

(a) Batura (b) Biafo
(c) Potwar (d) Hispar.

141. The North of a place can be found by different ways. Which of the following is not the method of determining the North?

(a) With the help of the pole star.
(b) By means of Mariner's compass.
(c) With the help of vertical rod.
(d) By circumnavigation

142. The axis of the Earth is inclined at an angle of $66\frac{1}{2}°$ the horizontal. This is called obliquity of the Earth's axis. Which of the following phenomenon is due to this?

(a) The seasons in the two hemisphere are opposite.
(b) Days and nights are of unequal length.
(c) The altitude of the midday Sun varies at different periods of the year.
(d) All the above are correct.

143. Vertical rays of sun are hotter than the slanting rays on the surface of the Earth because:

(a) Vertical rays pass through lesser volume of air than the slanting rays.
(b) Vertical rays spread over a smaller area than the slanting rays.
(c) Due to both (d) Neither due to (a) nor (b)

[redacted]

144. Pressure is represented on maps by joining all places having the same pressure by means of lines. These lines are called:

(a) Isotherms (b) Isobars

(c) Isotopes (d) Isomorphs.

145. Temperature is represented on maps by joining places having the same average temperature by means of lines These lines are called:

(a) Isobars (b) Isohels

(c) Isomorphs (d) Isotherms

146. The monsoon, the land and sea breezes are examples of what kind of winds?

(a) Constant winds (b) Variable winds

(c) Periodical winds (d) Trade winds.

147. The ocean water is never at rest. There are several movements in it. Which one of the following is not a movement of the ocean?

(a) Waves (b) Bores

(c) Currents (d) Tides.

148. Latitude is the distance of a place north or south of the equator along a meridian. This distance is measured in degrees. Some important latitudes are given below. Which of the following values is not correct?

(a) The latitude of Tropic of Cancer is $23\frac{1}{2}^\circ$ East.

(b) The latitude of Tropic of Capricorn is $23\frac{1}{2}^\circ$ South.

(c) The latitude of the Arctic Circle is $66\frac{1}{2}^\circ$ North.

(d) The latitude of the Antarctic Circle is $66\frac{1}{2}^\circ$ South.

149. The Earth rotates around its axis once in 24 hours and thus covers 360° in 24 hours. How much time the Earth takes to cover one degree of latitude?

(a) 4 hours (b) 4 minutes

(c) 4 half hours (d) 4 seconds.

150. The International Date Line is situated at a longitude of:

(a) 180° East (b) 180° West

(c) Both at (a) and (b) (d) Neither at (a) nor (b)

151. Himalayan, Rockies, Andes and Alps are examples of which of the following kinds of mountains?

(a) Fold mountains (b) Block mountains

(c) Mountains of accumulation (d) Mountains of denudation.

152. Which of the following is a dormant volcano?

(a) Stromboil (b) Vesuvius in Italy

(c) Mount Popa in Burma (d) Krakotoa in East Indies.

153. Which one of the following is not the area of heavy rainfall in the world?

(a) The Amazon Valley (b) Kalahari

(c) Cherrapunji in Khasi Hills (d) The Congo Valley

154. Which one of the following countries is not included in the region of Monsoons?

(a) Pakistan (b) India

(c) Saudi Arabia
(d) China.

155. There is more than one way in which air of the atmosphere is made to throw off its excess water vapour as rain. Which of the following is not an example of the type of rainfall.

(a) Relief rain
(b) Frontal rain
(c) Convection rain
(d) Wet rain.

156. Rainfall is measured in inches by means of a rain-gauge. Rainfall may be recorded on maps by:

(a) Isomorphs
(b) Isohels
(c) Isohyets
(d) None of the above.

157. There are about 3100 cubic miles of water present in the atmosphere in the form of clouds. Clouds are of various kinds and are classified by their height and appearance. Which of the following is not a class of clouds?

(a) Cirrus
(b) Stratus
(c) Cumulus
(d) Frontal.

158. Which one of the following class of cloud means "a rain-cloud"?

(a) Nimbus
(b) Cumulus
(c) Stratus
(d) Cirrus.

159. Which one of the following types of clouds give the sky a watery appearance,

(a) Altocumuhus
(c) Cirrocumulus
(b) Altostratus
(d) Cirrostratus.

160. Which one of the following types of clouds stand highest from the surface of the Earth?

(a) Cirrus
(b) Stratocumulus
(c) Altostratus
(d) Altocumulus.

161. Which one of the following types of clouds stand lowest from the surface of the Earth?

(a) Altostratus
(b) Cirrostratus
(c) Stratus
(d) Nimbostratus.

162. What is approximately the maximum height a cloud can stand and float in the atmosphere?

(a) 20,000 feet
(b) 20,000 feet
(c) 200 feet
(d) 100 feet.

163. Strong winds accompanied with thunder and lightning are known as Thunderstorms. These are generally of local origin, caused by simultaneous heating and cooling. Which one of the following conditions is idea for the development of a thunderstorm?

(a) Strong convection
(b) High humidity
(d) Increasing temperatures
(d) All the above.

164. Cyclone is a storm caused by rotating winds. The word cyclone is derived from the Greek word Kyklos which signifies, amongst other things, the coil of a snake. Which one of the following countries is not more commonly hit by cyclones?

(a) Bangladesh (c) Libya
(b) Philippines (d) Australia.

165. What factors contribute towards the severity of the cyclone?
(a) Maximum wind speeds. (b) Pressure deficit
(c) Radius of the eye (d) All the above.

166. Tornadoes are violently rotating, funnel-shaped atmospheric disturbances. Th severity of a Tornado can be expressed in terms of the Torro scale used in the U.K., i is based on the extent of the damage caused. Which of the following countrie experiences more powerful tornadoes?
(a) U.S.A. (b) Pakistan
(c) Bangladesh (d) Canada.

167. The Suez Canal, the biggest of its kind lies within the territory of Egypt and was du across the Isthmus which connects Asia with Africa. This canal was designed and constructed by an engineer named Ferdinand de Lessepe. What was the nationality of the engineer?
(a) German (b) French
(c) English (d) American

168. When was the Suez Canal opened for traffic?
(a) 1869 (b) 1860
(c) 1865 (d) 1866.

169. What is the approximate length of the Suez Canal?
(a) 140 km (b) 150 km
(c) 160 km (d) 170 km.

170. Which two seas are connected by the Suez Canal?
(a) Caribbean and Red Sea.
(b) Mediterranean and Red Sea.
(c) Mediterranean and Baltic Sea.
(d) North and Baltic Sea.

171. The Panama Canal is another man-made important canal situated in Panama. Whe was this constructed?
(a) 1914 (b) 1913
(c) 1912 (d) 1911.

172. What is the approximate length of the Panama Canal?
(a) 30 miles (b) 40 miles
(c) 50 miles (d) 60 miles.

173. Which two oceans are connected by the Panama Canal?
(a) Pacific and Indian Ocean. (b) Pacific and Atlantic Ocean.
(c) Pacific and Artic Ocean. (d) Atlantic and Indian Ocean.

174. Which one of the following Passes in the northern mountains of Pakistan connect Abbottabad and Gilgit.
(a) The Lawari Pass. (b) The Shandur Pass

(c) The Muztagh Pass
(d) The Babusar Pass.

175. Name the largest barrage in Pakistan?
(a) Chasma Barrage
(b) Rasul Barrage
(c) Sukkur Barrage
(d) Qadirabad Barrage.

176. What is the colour of the lunar soil?
(a) Bluish
(b) Brownish
(c) Greyish
(d) Yellowish

177. Which city of the world is called as the city of canals?
(a) Lahore (Pakistan)
(b) Venice (Italy)
(c) New York (U.S.A.)
(d) Paris (France)

178. Which city of India is considered the "Mecca of Hindus"?
(a) Bombay
(b) Benares
(c) Delhi
(d) Amritsar.

179. Name the world's biggest fresh water lake.
(a) Lake Baikal (Russia)
(b) Great Bear (N. America)
(c) Victoria (Africa)
(d) Eyre (Australia)

180. How do the following personalities come in chronological order? Socrates, Plato, Aristotle, Caesar.
(a) Plato, Socrates, Caesar, Aristotle.
(b) Socrates, Caesar, Plato, Aristotle
(c) Plato, Socrates, Aristotle, Caesar.
(d) Socrates, Plato, Aristotle, Caesar.

181. Which is the oldest University in the world?
(a) Oxford University (England)
(b) Cambridge University (England)
(c) Heidelberg University (Germany)
(d) Al-Azhar University (Egypt)

182. Name the only English speaking country in Latin America.
(a) Hunduras
(b) Guatemala
(c) Mexico
(d) Costa Rica.

183. Japan is known as the "Land of the rising Sun", which country is called "Land of the mid-night Sun."?
(a) Sweden
(b) Norway
(c) Finland
(d) Iceland.

184. Which Asian Capital is known as the "Venice of the East"?
(a) Bombay (India)
(b) Karachi (Pakistan)
(c) Manila (Philippines)
(d) Bangkok (Thailand)

185. Name the country which is known as the "Playground of Europe."
(a) Switzerland
(c) France
(b) Austria
(d) Italy.

186. Name the part of the world which is called the roof of the world.
(a) Mongolia (b) Tibet
(c) Nepal (d) China.

187. Which geographical parallel divides North and South Korea?
(a) 38th parallel (b) 37th parallel
(c) 36th parallel (d) 35th parallel

188. Name the country which leads the world in steel production.
(a) Russia (b) U.S.A.
(c) France (d) Canada

189. Which is the southern — most state of U.S.A.?
(a) Hawaii (b) Alaska
(c) Florida (d) Maine

190. Name the country which has the greatest number of volcanoes in the world.
(a) Japan (b) Indonesia
(c) Mexico (d) Ecuador

191. Which state of U.S.A. is called the "Mother of President".
(a) Virginia (c) California
(b) Washington (d) Georgia.

192. Which one of the following languages is most spoken by the people in the world?
(a) English (b) Chinese
(c) Hindi (d) Russian.

193. Name the World's highest waterfall.
(a) Lofoi (Zaire) (b) Tugela (South Africa)
(c) Angel (Venezuela) (d) Mongefossen (Norway)

194. Name the deepest cave in the World.
(a) Gouffre Jean Bernard (France)
(b) Shneeloch Salzburg area (Austria)
(c) Sima GES Maloga (Spain)
(d) Kilsi (USSR)

195. Name the World's tallest building.
(a) Empire State (New York) (b) Sears Tower (Chicago)
(c) Standard Oil (Chicago) (d) World Trade Centre (New York)

196. What is the more exact geographical name for a tableland"?
(a) A Hill (b) A Plateau
(c) A Mountain (d) A Headland.

197. What do Fiji, New Caledonia, Tonga and Samoa have common?
(a) All are volcanoes (b) All are mountains
(c) All are islands (d) All are in U.S.A.

198. What is Peninsula?
(a) A narrow neck of land that connects two larger landmasses

(b) A narrow waterway separating two bits of land
(c) A tip of land which projects into the sea
(d) A piece of land surrounded by water on three sides.

199. What is the geographical name for land's "end"?
(a) A Cape
(b) A Strait
(c) A Spit
(d) An Island

200. Gorge is a narrow passage through land. Name the largest gorge in the world:
(a) Grand Canyon, U.S.A.
(b) Death Valley
(c) Kashmir Valley
(d) Marble Rocks.

201. When does the Summer Solstice occur?
(a) July 21
(b) June 21
(c) April 14
(d) May 20.

202. When does the Winter Solstice occur?
(a) December 22
(b) January 21
(c) November 23
(d) October 20

203. The intermediate positions of the Earth in March and September, which are the transitional seasons of spring and autumn respectively, are called equinoxes. When does the autumn equinox occur?
(a) September 20
(b) September 21
(c) September 22
(d) September 23.

204. When does the spring equinox occur?
(a) March 19
(b) March 20
(c) March 21
(d) March 22

205. What happens during the Equinoxes?
(a) The Sun shines vertically over the equator:
(b) Length of days and nights are equal all over the world.
(c) Both hemisphere experience the similar seasons.
(d) All the above are correct.

206. What is the name of the mountain in Sri Lanka which is considered sacred to people of all faiths?
(a) Matton Hill
(b) Adam's Peak
(c) Pidrut Alagla
(d) Nuwara Eliya

207. Name the legendary pass that links Pakistan with Afghanistan.
(a) Bolan Pass
(b) Chitral Pass
(c) Khyber Pass
(d) Babusar Pass.

208. Karakoram Highway is the miracle of mechanical engineering work. Name the two countries which are joined by the highway.
(a) Pakistan and Nepal
(b) Pakistan and China
(c) India and China
(d) Pakistan and Afghanistan.

209. Name the river on which the Tarbela Dam is built,
(a) Satluj
(b) Ravi

(c) Jhelum
(d) Indus.

210. Chuquicamata, the largest known deposit of copper ore in the world, is on the northern edge of the Atacama desert in:
(a) Mexico
(b) Peru
(c) Chile
(d) Argentina

211. What was once Yugoslavia ________ is now divided into Serbia, Slovenia, Bosnia, Macedonia, Croatia, Montinegras, Kosovo and Vono Dina. These republics are collectively called:
(a) The Irish
(b) The Balkans
(c) The Republicans
(d) The Kurds.

212. These seasonal rams are a life bread of half of the world ________ they bring each year both havoc and renewal blessed and cursed, destructive and sustaining. These rains are called:
(a) Torrentials
(b) Tropical
(c) Monsoons
(d) Blizzard

213. Name the world's biggest hydropower station which generates about 12,600 M. W of electricity.
(a) Yangtze Dam
(b) Brazil's Itaipu Dam
(c) Tarbela Dam
(d) Normada Dam

214. The power of sunlight captured million of yeas ago by plants and animals and burned in large deposits under the bed of the Earth, is now being used as a fuel for the production of energy. Name the fuel:
(a) Coal
(b) Petroleum
(c) Natural gas
(d) All the above.

215. The Hub Power Project in Pakistan is sponsored by Xenel of Saudi Arabia and a hos of other multinationals. It is one of the biggest private power project in Asia and i considered to be trail blazer for other private projects in the region. About how much energy would be produced by this project?
(a) 300 Megawatt
(b) 600 Megawatt
(c) 900 Megawatt
(d) 1200 Megawatt.

216. Summer Olympics of 1984, 1988 and 1992 were respectively held at Los Angeles Seoul and Barcelona. Name the place where Summer Olympics of 1996 were held:
(a) Moscow
(b) Montreal
(c) Atlanta
(d) Beijing.

217. Ruby is a precious gem-stone. Name a country in South Asia which is famous for the ruby mines.
(a) Pakistan
(b) Myanmar
(c) India
(d) Bhutan

218. What is the name of Bangladesh's major sea-port?
(a) Barguna
(b) Dacca
(c) Chittagong
(d) Cox's Bazar.

219. Maldives is a beautiful tropical country located in Indian ocean. This country is composed of many islands. About how many islands are present in Maldives?
(a) About 500
(b) About 1000
(c) About 1500
(d) About 2000.

220. Siam is an old name of which of following countries?
(a) Sri Lanka
(b) Thailand
(c) Laos
(d) Cambodia.

221. What is the direction of the rotation of Earth around its axis?
(a) From North to South
(b) From East to West
(c) From West to East
(d) From South to North.

222. Fuji is the name of a mountain. It is also a dormant volcano. Where is this situated?
(a) Korea
(b) Japan
(c) Indonesia
(d) China

223. Mongolia is land-locked from all sides by Russia and China. What is the major agricultural activity of Mongolia?
(a) Wheat growing
(b) Sheep farming
(c) Stock raising
(d) Horticulture

224. Name the country which is separated into two parts by UAE:
(a) Yemen
(b) Bahrain
(c) Oman
(d) Qatar

225. Which of the following "Gulf country" is an Island?
(a) Bahrain
(b) Qatar
(c) UAE
(d) Kuwait.

226. Istanbul is an important city of Turkey. One part of this city is in Europe and the other part is in Asia. What is the name of the sea which separates European and Asian Turkey?
(a) North Sea
(b) Sea of Marmora
(c) Black Sea
(d) Dead Sea.

227. Chile is located on the southwest coast of South America. What is the major language of Chile?
(a) English
(b) Spanish
(c) French
(d) German.

228. Which one of the following country does not have Spanish as the major language?
(a) Colombia
(b) Panama
(c) Mexico
(d) Brazil

229. What country is usually called as The Cockpit of Europe?
(a) Germany
(b) Italy
(c) Belgium
(d) Austria.

230. Which one of the following countries is biggest in area?
(a) China
(b) U.S.A.
(c) Brazil
(d) Australia.

231. Which city of the world is called "City of Seven Hills"?
(a) Pans (b) Rome
(c) Moscow (d) Belgrade.

232. Which country is called "Sugar Bowl" of the World?
(a) Indonesia (b) Cuba
(c) Brazil (d) Pakistan

233. Name the highest mountains in Europe.
(a) Rocky (b) Andes
(c) Mount Everest (d) Alps.

234. Which part of the world is called "the land of thousand lakes"?
(a) Holland (b) Finland
(c) Italy (d) Thailand

235. The coast of which country is known as the "gold coast"
(a) Nigeria (b) Chad
(c) Ghana (d) Togo

236. Name the largest lake in West Africa
(a) Lake Voita (b) Lake Chad
(c) Lake Kainji (d) Lake Faguibire.

237. Where is copper belt situated?
(a) Zimbabwe (b) Zambia
(c) Nigeria (d) Kenya.

238. What separates Africa from Asia?
(a) The Red Sea (b) The Suez Canal
(c) Sinai (d) The Horn

239. Kalahari is a famous desert in Africa. In which country it is situated?
(a) Angola (b) Libya
(c) Nigeria (d) Botswana.

240. What is the major mineral wealth of South Africa?
(a) Petroleum and gas. (b) Oil and iron.
(c) Gold and Diamonds (d) Tin and Nickel.

241. River Nile is the longest river of the world. Name the two countries through which it passes.
(a) Egypt and Chad (b) Egypt and Niger
(c) Egypt and Sudan (d) Egypt and Kenya.

242. Where do White Nile and Blue Nile meet to yield the main river Nile?
(a) Khartoum (b) Malakal
(c) Cairo (d) Atbara

243. Name the countries which surround the Lake Victoria in Africa.
(a) Angola, Uganda and Kenya.
(b) Uganda, Kenya and Tanzania

(c) Angola, Uganda and Tanzania
(d) Uganda, Kenya and Ethiopia.

244. Which of the following is not a sea port in Africa.
(a) Dar-es-Salaam (b) Maputo
(c) Port Elizabeth (d) Lusaka.

245. Which of the following is the main sea-port of Senegal:
(a) Freetown (c) Cape Town
(c) Dakar (d) Conarky.

246. What is common among: Lagos, Accra and Abid Jan?
(a) All are situated in the Northern hemisphere
(b) All are landlocked from all sides.
(c) All are sea-ports.
(d) All are the parts of Ghana.

247. Addis Ababa is the capital of which country.
(a) Sudan (b) Chad
(c) Ethiopia (d) Kenya.

248. Name the two countries through which Congo River passes in Africa.
(a) Congo and Zaire (b) Congo and Angola
(c) Congo and Gabon (d) Congo and Cameroon.

249. Where is Katanga Plateau located?
(a) In Asia (b) In Africa
(c) In Europe (d) In Australia.

250. White Nile passes through Sudan, where does Blue Nile pass through?
(a) Chad (b) Ethiopia
(c) Libya (d) Somalia.

251. River Mississippi-Missouri of USA empties into:
(a) Atlantic Ocean (b) Gulf Mexico
(c) Pacific Ocean (d) North Sea.

252. The most massive clock in the world is the astronomical clock in the Cathedral of St. Pierre, Beauvais. Name the country.
(a) Germany (b) England
(c) France (d) Austria.

253. Name the country which has the world's oldest constitution
(a) England (b) U.S.A.
(c) Spain (d) Australia.

254. Which of the following is among the seven wonders of the Medieval world?
(a) Great Wall of China
(b) Stonehenge of England.
(c) -- Leaning Tower of Pisa
(d) All the above.

255. Name the only American President who won the election consecutively for four terms 1933-45. He was also the principal mover for the U.N.O.
(a) Abraham Lincoln (b) John F Kennedy
(c) Franklin D. Roosevelt (d) Ronald Reagan.

256. Vasco Da Gama was the Portuguese explorer who discovered the direct route from Europe to India by sailing around Africa What was his life span?
(a) 1460-1524. A.D. (b) 1027-1087 A.D.
(c) 1469-1527 A.D. (d) 1370-1440 A.D.

257. Name the American scientist who patented more than 1000 inventions.
(a) R.W. Watt (b) James Watt.
(c) W. Shokley (d) Thomas Alva Edison.

258. Queen Isbella was the Queen of Spain, who financed Christopher Columbus's voyage across the Atlantic to discover, what is now America? What was her life Spain?
(a) 1451-1504 A.D (b) 1351-1403 A.D.
(c) 1251-1304 A.D. (d) 1151-1204 A.D.

259. At last, the Berlin Wall has fallen apart, and its pieces are now sold as souvenirs. When was it built?
(a) 1951 (b) 1941
(c) 1961 (d) 1971

260. Where is World's largest gas field located?
(a) Libya (b) Saudi Arabia
(d) Kuwait (d) Russia.

261. Marienbad is the name of an internationally famous health resort. In which country it is located?
(a) Austria (b) Belgium
(d) Italy (d) Czechoslovakia.

262. How many states compose U.S.A?
(a) 49 (b) 48
(c) 50 (d) 51

263. Name the World's oldest railway station?
(a) Victoria (b) Bombay
(c) Liverpool (d) Pans

264. What is the name of river which passes through countries of Europe namely: Germany, Czechoslovakia, Hungary, Yugoslavia and Romania?
(a) Danube (b) Rhine
(c) Elbe (d) Oder

265. River Mississippi-Missouri of U.S.A. empties into:
(a) Atlantic Ocean (b) Gulf of Mexico
(c) Pacific Ocean (d) North Sea.

266. Where is the source of Amazon river located?
(a) Peru (b) Chile
(c) Bolivia (d) Argentina

267. Name the river that cuts an enormous arc thorough the heart of the African continent ________ an immense snake uncoiled with its head in the sea and its tail lost in the depths of the land". It crosses the equator twice.
(a) Volta river (b) Niger river
(c) Amazon river (d) Zaire river

268. The new name of Burma is Myanmar. What is the new name of Rangoon?
(a) Mandalay (b) Moulmem
(c) Yangon (d) None of the above.

269. Alcan is the name of the Alaska _______ Canada Military Highway stretching from Dawson Creek (Canada; to Fairbanks (U.S.A.). It was built during Second World War to counter any invasion of Japanese forces. What is its approximate length?
(a) 1200 miles (b) 1500 miles
(c) 1300 miles (d) 1400 miles.

270. Name one of the World's most polluted bodies of water located in Asia. It pays heavily for its role as "the Middle East Oil Highway A quarter of a million barrels of oil pollute it each year, yet the gulf takes more than 5 years to flush contaminated water through the narrow strait of Hormuz.
(a) Gulf of Mexico (b) Gulf of Alaska.
(c) Persian Gulf (d) Gulf of Aden

271. Santo Fe is the West's longest lived trail stretching from Franklin to Santa Fe in U.S.A. What is the length of this trail?
(a) 900 miles (b) 800 miles
(c) 700 miles (d) 600 miles.

272. The snow covered top of Mount Fuji mirrors the Japanese dawn, it catches the Sun's first light. Fuji's summit turns from lacquer red to rose. In the shadows below, the mountain's huge sloping shoulders and base remains dimly outlined in predawn gray. What is the height of Mountain Fuji?
(a) 11,388 feet (b) 12,388 feet
(c) 14,388 feet (d) 19,388 feet

273. Name the Lake in Africa which is famous for the living Jewels ________ a brilliant aquatic menagerie called Cichlids populates this lake.
(a) Lake Malawi (b) Lake Victoria
(c) Lake Tanganyika (d) Lake Nasser.

274. The Murry and Darling rivers are the major components of a system that drains 410,000 square miles ______ nearly the combined size of France and Spain. They empty into Indian Ocean. Where are they located?
(a) China (b) Australia
(c) Brazil (d) Canada.

275. Statue of Liberty is the World's largest metal statue, a tangible Pledge of Frenc American friendship, and a beacon to immigrants. It stands on the Upper New Yor Bay. In which year was this statue gifted to America by France?

(a) 1876
(b) 1877
(c) 187S
(d) 1879

276. Name the smallest, flattest and driest continent of the World:

(a) Antarctica
(b) Australia
(c) South America
(d) Africa.

277. Name the country that is shaped like a kite, the largest country on the south eas Asian mainland. Though it ranks among the ten poorest nations in the world, it is self-sufficient in food:

(a) Nepal
(b) Bhutan
(c) Burma
(d) Bangladesh

278. Who discovered West Indie?

(a) Vasco da Gama
(b) Christopher Columbus
(c) Captain Cook
(d) Sir Francis Druke.

279. Big Apple is the nick-name of a city in U.S.A. What is the original name of the city?

(a) New York
(b) Los Angeles
(c) Houston
(d) Washington

280. A Cascade of cutters (Red Crabs) turns the street of this Island red in Indian Ocean as 120 million forest-dwelling crabs migrate every year to seaside breeding grounds Name the Island.

(a) Christmas Island
(b) Krakatau Island
(c) Nassau Island
(d) Fiji Island

281. Great Salt Lake is the largest lake west of the Mississippi in U.S.A. In which state it is located?

(a) Utah
(b) Arizona
(c) Colarado
(c) Idaho.

282. Which country is called the "Sick Man of Europe"?

(a) Greece
(c) Hungary
(b) Turkey
(d) Poland

283. Name the country which produces the largest quantity of coffee.

(a) Sri Lanka
(b) Brazil
(c) Uganda
(d) Congo.

284. Pakistan is 5 hours ahead of GMT. Which one of the following places is ahead of 12 hours?

(a) Cook Islands
(b) Vladivostok
(c) New Zealand
(d) Papua New Guinea.

285. Name the most populous city in the world.

(a) Tokyo
(b) Bombay
(c) New Mexico
(d) London.

286. The longest railway journey in China is from Beijing to Urumchi and it takes about four and a half days. What is the name of the train for this journey?
(a) The Iron Rooster (b) The Restless Dragon
(c) The Red Guard (d) The Non-stop Arrow.

287. Name the city which has the largest number of Windmills in the World.
(a) Copenhagen (b) Amsterdam
(c) Merida in Mexico (d) El Salvador.

288. Golden Triangle is an area in Southeast Asia which is famous for growing most of the World's opium. What countries form this triangle?
(a) Thailand, Burma, Laos
(b) Malaysia, Thailand, Laos
(c) Burma, Kampuchea, Thailand
(d) Bhutan, Burma, Laos.

289. Name the longest river in Italy
(a) Servo (b) Po
(c) Tiber (d) Arno

290. Name the sea that separates Britain from Scandinavia:
(a) The North Sea (b) English Channel
(c) Arctic Ocean (d) Black Sea.

291. Hind of Sardinia is a tourist attraction. Where is this located?
(a) France (b) Greece
(c) Turkey (d) Italy

292. What is the composition of United Kingdom?
(a) England and Scotland
(b) England and Wales.
(c) England, Scotland, Wales and Northern Ireland
(d) England, Scotland, Wales and Belfast.

293. Name the country which is locked from all sides by the Aegean Sea:
(a) Turkey (b) Greece
(c) Italy (d) Spain

294. Where is both Cape Canaveral and Disney World located?
(a) Georgia (b) Texas
(c) California (d) Florida.

295. Name the biggest Canadian Island:
(a) New Foundland (b) Victoria
(c) Devon (d) Baffin

296. Name the smallest state of U.S.A.
(a) Rhode Island (b) Maine
(c) Vermont (d) Georgia.

297. Niagara Falls is one of the Widest Waterfalls of the World. What is its location?
(a) U.S.A. (b) Bermuda
(c) Bahamas (d) Canada.

298. Where is Mosquito Coast located?
(a) Nicaragua (b) El Salvador
(c) Costa Rica (d) Honduras.

299. Name the only country in South America which shares both Atlantic and Pacific coast.
(a) Peru (b) Colombia
(c) Chile (d) Venezuela.

300. Name the river which is shared by Argentina, Paraguay and Brazil.
(a) Amazon (b) Madeira
(c) Parana (d) Paraguay

301. A branch of science which deals with the study of the Earth's crust is called:
(a) Morphology (b) Geology
(c) Histology (d) Climatology.

302. Who is known as the Father of Geology?
(a) Alfred Wegener (b) Charles Lyell
(c) James Hutton (d) Philon.

303. Who discovered the first Homo Erectus Fossil ________ the Java Apeman?
(a) Eugene Dubois (b) Raymond Dart
(c) Mary Leakey (d) Philon.

304. The discovery of frozen Stone Age Man in 1992 on the melting Similun glacier high in the Alpine yields new clues about life in 3300 B.C. His body was so remarkably preserved for about 500 years ________ the World's most ancient intact human. Name the two countries which are trying to get the legal possession of the dead body.
(a) Italy and Switzerland (b) Italy and Austria.
(c) Austria and Switzerland (d) Turkey and Italy.

305. Meteorites have hit the surface of our Earth several times in past and punched craters. Arizona's Barringer Meteorite Crater, punched out some 50,000 years ago by iron rich meteorite, is 550 feet deep and 3,900 feet across. Name the country where it is situated?
(a) Russia (b) U.S.A.
(c) Australia (d) Canada.

306. Geological time scale is a scale of time that serves as a reference for correlating various events in history of the Earth; it has been built up by studying the various strata of rocks that comprise the Earth's crust with special reference to the fossils found in them. This time scale is divided into three main "eras" based upon the general character of the life that they contain. Which one of the following is not an example of such an era?
(a) Paleozoic (b) Mesozoic
(c) Permian (d) Cenozoic.

307. Each era of geological time scale is divided into periods. Which of the following periods is not an example of Paleozoic era?
(a) Cambrian
(b) Devonian
(c) Triassic
(d) Permian.

308. Which of the following periods is not an example of Mesozoic or Secondary era?
(a) Eocene
(b) Cretaceous
(c) Jurassic
(d) Triassic

309. Which of the following periods is not an example of Cenozoic era?
(a) Oligocene
(b) Silurian
(c) Miocene
(d) Pliocene.

310. What is the approximate age of Mesozoic era?
(a) 135 to 225 million years
(b) 270 to 400 million years.
(c) 10 to 70 million years
(d) 400 to 300 million years.

311. The surface of the Earth is made up of land and water. The land surface is divided into continents. Name the continent which is the largest in area?
(a) Europe
(b) Asia
(c) Africa
(d) North America.

312. Name the continent which is the smallest in area.
(a) South America
(b) Europe
(c) Australia
(d) Africa.

313. About 200 million years ago, virtually all the Earth's dry land was contained in the original super-continent. What is it called?
(a) Laurasia
(b) Gondwana
(c) Pangaea
(d) None of the above.

314. What is the total number of continents in this world?
(a) Five
(b) Seven
(c) Six
(d) Five.

315. Who was the first to prove continental drift?
(a) Alfred Wegener
(b) Antonio Snider
(c) Mary Leakey
(d) Philon.

316. The interior of the Earth consists of three main layers namely, the Crust, the Mantle and the Core. The existence of the earth's core came to light from the detection of a shadow zone for seismic waves extending from 100 to 140 degrees from a source of earthquakes. Who discovered this?
(a) I. Lehmann
(b) D. Davies
(c) B. R. Julian
(d) R. M. Sheppardb.

317. The Earth is like an onion and it consists of layers. These layers have been named by different people in different ways. Lithosphere, Pyrosphere and Barysphere have respectively been named as Sial (Silica + Aluminum), Sima (Silica. + Magnesium) and Nife (Nickel and Ferrous) depending upon their composition. Name the geologist who gave this nomenclature:
(a) R. A. Dally
(b) Gracht

(c) Gilbert
(d) Romney.

318. The topmost layer of the Earth, which forms the crust of the Earth is the lightest layer of the Earth. This is also called as the Lithosphere. What is the average thickness of Lithosphere?

(a) 20 miles
(b) 30 miles
(c) 40 miles
(d) 50 miles.

319. The oceans and continents are the main features of the surface of the Earth. There is a definite plan or order underlying the distribution of land and water on the surface of the Earth. Which one of the following theories explain this distribution?

(a) Tetrahedral
(b) Suess's Theory
(c) Wegner's Theory
(d) All the above.

320. According to Tetrahedral theory, the land masses are situated just opposite the water bodies. If we draw a straight line which will pass through its centre, its one end will touch the land masses and the other will touch the water bodies. Thus land and see occupy antipodal position. Europe and Africa are situated in the Antipodes of the Pacific Ocean. Asia and Australia are antipodal to what?

(a) Pacific Ocean
(b) Indian Ocean
(c) Atlantic Ocean
(d) Arctic Ocean.

321. What is North America antipodal to?

(a) Arctic Ocean
(b) Atlantic
(c) Pacific Ocean
(d) Indian Ocean.

322. Just as time on a clock is divided into hours, minutes and seconds, so is the Earth's history divided into geological time units. Which of the following units of the geological clock is the longest?

(a) Ears
(b) Eons
(c) Periods
(d) Epoctis.

323. Which of the following units of the geological clock is the shortest?

(a) Periods
(b) Epochs
(c) Ages
(d) Chrons.

324. The Scottish geologist James Button is the founder of modern geology. He pointed out that continents are worn away by rivers and that sediments washed into the sea forms into new sedimentary rocks. Which of the following periods correspond to his life span?

(a) 1726-1750
(b) 1740-1798
(c) 1720-1780
(d) 1710-1770.

325. Who showed first that the Earth is a giant magnet?

(a) Gerardus Mercaton
(b) William Gilbert
(c) Alfred Wegener
(d) Leopold Buch.

326. Rock is any mass of natural deposit which forms the solid part of the Earth's crust. Rocks are classified on the basis of their origin. What rocks are formed by the agency of fire?

(a) Igneous rocks
(b) Sedimentary rocks

(c) Metamorphic rocks
(d) Weathered rocks.

327. What rocks are formed by the agency of water, wind and ice?
(a) Plutonic rocks
(b) Sedimentary rocks
(c) Volcanic rocks
(d) Dyke rocks.

328. Which of the following is not an example of Igneous rocks?
(a) Alkali rocks
(b) Silicon rocks
(c) Plutonic rocks
(d) Aqueous rocks.

329. The sedimentary rocks are comparatively soft and these may be formed mechanically, chemically or organically. Which of the following is a typical example of a chemically formed sedimentary rock?
(a) Chalk
(b) Limestone
(c) Gypsum
(d) Sand.

330. The sedimentary rocks may also be classified as Inorganic or Organic rocks. Which of the following is a sub-class of Organic rocks?
(a) Argillaceous rocks
(b) Mechanically formed rocks.
(c) Arenoceous rocks
(d) Carbonaceous rocks.

331. Metamorphic rocks are igneous and aqueous rocks which have changed in form and whose characteristics have alter due to pressure and heat. Which of the following example of metamorphic rock:
(a) Slate
(b) Gneiss
(c) Quartzite
(d) All the above.

332. What is Graphite?
(a) It is an example of igneous rock
(b) It is an inorganic rock.
(c) It is hardened and steam coal.
(d) It is an example of basic rock.

333. Volcanoes are those sudden and abrupt explosions of smoke, dust and lava which astound human understanding. About how many active volcanoes are present on the Earth?
(a) 500
(b) 400
[✓ (c) 300]
(d) 200

334. What is the mouth of a volcano called?
(a) Vent
(b) Plug
(c) Crater
(d) Cone

335. What is the nature of the material thrown out by a volcano?
(a) Liquid
(b) Solid
(c) Gaseous
(d) All the above

336. The liquid material of a volcanic eruption is the most important and is known as the:
(a) Volcanic ash
(b) Cinder fragments
(c) Lava
(d) Breccia.

337. Sometimes the lava thrown into the air solidifies into a round mass before falling to the Earth and this is known as:

(a) Volcanic ash (b) Volcanic bomb

(c) Volcanic dust (d) Volcanic lava.

338. The volcanoes of the Earth have different shapes and sizes. Their shapes and sizes depend upon the material that has been thrown out and have gone into their formation. A dome-shaped volcano with steep slopes is called:

(a) Lava dome (b) Cinder cone

(c) Composite cone (d) Driblet cone.

339. The lava domes are quite common in which of the following countries?

(a) U.S.A. (b) Russia

(c) Germany (d) Italy

340. Volcanoes act as windows into the Earth. Volcanoes of which place are the most thoroughly studied?

(a) Philippines (b) Indonesia

(c) Hawaii (d) Japan.

341. The crust of the Earth is dynamic. Geologists have found that the crust is made up of moveable tectonic plates. How many tectonic plates make the Earth's crust?

(a) 2 (b) 4

(c) 10 (d) 20

342. Earthquakes are those movements of the Earth's crust which make it vibrate and shake the ground backwards and forwards. Most of the earthquakes occur where the tectonic plates meet. By which scale is the severity of an earthquake measured?

(a) Index scale (b) Fischer scale

(c) Richter scale (d) Absolute scale

343. When an earthquake is accompanied by a volcanic eruption — it is called as:

(a) Tectonic earthquake (b) Volcanic earthquake

(c) Plutonic earthquake (d) Fracture earthquake.

344. Whenever an earthquake occurs, waves start to travel in all directions from the source of the disturbance. Name the instrument which detects these disturbances.

(a) Spectrograph (b) Holograph

(c) Seismograph (d) Cardiograph.

345. A person who is an expert in dealing with the earthquakes is called:

(a) Analyst (b) Seismologist

(c) Agronomist (d) Chemist.

346. The place within the Earth where the disturbance begins, is known as the focus and from this focus start waves that move the rocks of the crust. The place immediately above the focus on the surface of the Earth is known as:

(a) Epicentre (b) Autocentre

(c) Gravity centre (d) Local centre.

347. The waves that originate from the focus radiate in all directions in concentric circles and according to their mode of travelling and rate of movement, these are given specific names. Which of the following is not a type of earthquake waves?
(a) Longitudinal waves (b) Transverse waves
(c) Surface waves (d) Electromagnetic waves.

348. Which one of the following tectonic plates does not have any continent?
(a) American plate (b) African plate
(c) Pacific plate (d) Eurasian plate.

349. On which tectonic plate is Pakistan situated?
(a) Pacific plate (b) Indo-Australian plate
(c) American plate (d) Eurasian plate.

350. On which tectonic plate is Rocky mountains situated?
(a) African plate (b) Pacific plate
(c) Indo-Australian plate (d) American plate.

351. Rocks are made of chemicals called minerals. Minerals are formed by natural processes these are generally crystalline and inorganic. About how many minerals are presently known?
(a) 1000 (b) 2000
(c) 3000 (d) 4000

352. Who classified the minerals according to chemical composition on modem lines?
(a) Axel Fredrik Gronotedt (b) James Dwight Dana
(c) Theophrastus (d) Waldemar Lingren.

353. Which of the following is an important physical property of minerals?
(a) Hardness (b) Cleavage
(c) Specific gravity (d) All the above.

354. The simplest estimate of the hardness of minerals involves scratching by reference minerals arbitrarily chosen for the Mohs scale which placed in numerical order of increasing hardness from 1 to 10. Who was Frieadrich Mohs?
(a) Professor of Physics (b) Professor of Mineralogy
(c) Professor of Geography (d) Professor of Chemistry.

355. Minerals result from a sequence of complex processes that began with chemical differentiation of the solar system to form planets and that ended in many cases with crystallization in rocks or ore bodies controlled by trivial local factors. Which of the following branch of science is important in the general understanding of the occurrence of minerals in nature?
(a) Geochemistry (b) Geophysics
(c) Petrology (d) All the above.

356. The property of hardness is dependent upon the strength of the forces holding atoms together in a solid. Name the hardest natural mineral.
(a) Quartz (b) Appetite
(c) Diamond (d) Corundum.

357. Name the second hardest natural occurring mineral.
(a) Corundum (b) Topaz
(c) Fluorite (d) Calcite.

358. Some knowledge of mineralogy is fundamental in most branches of geology. Which of the following sciences is closely related to mineralogy?
(a) Petrography (b) Petrology
(c) Geochemistry (d) All the above.

359. Who is considered as the founder of Petrology?
(a) William Nicol (b) Henry Clifton Sorby
(c) E.S. Fedfcrov (d) Paul Knipping.

360. All minerals have regular arrangement of atoms that have some geometrical symmetry. Which branch of physical science is involved in the structure determination?
(a) Holography (b) Crystallography
(c) Refractometry (d) Mass Spectrometry.

361. Crystals have varying amount of symmetry that is repetition of the basic structural elements by symmetry operators such as rotation axes and mirror planes. External shapes of crystals are described by crystal systems. How many crystal systems are necessary to describe the geometry of the crystals?
(a) Seven (b) Six
(c) Five (d) Four

362. The method of formation of minerals on the Moon is different from that of the Earth because of extreme dryness of the lunar surface. Under dry conditions, mineral concentrations arise principally from the process of liquid immiscribility and from gravity settling of crystals from liquid. Which one of the following is a principal mineral of the lunar surface?
(a) Pyroxene (b) Plagioclase
(c) Olivine (d) All the above.

363. Rocks which have enough metal in them to make mining worthwhile are called ores. Who gave the first classification of ores?
(a) Paual Knipping (b) Waldemar Lindgren
(c) E.S. Fedorov (d) William Nicol.

364. What are those ores called which are most commonly precipitated where former permeable zones intersected reactive rocks?
(a) Hypothermal (b) Hydrothermal
(c) Epithermal (d) Mesothermal.

365. Which one of the following is not an example of Hypothermal Ores?
(a) Cassiterite (b) Wolframite
(c) Scheelite (d) Atimony Sulphide.

366. Which one of the following is not an example of metamorphic minerals?
(a) Garnet (b) Tremolite
(c) Wolframite (d) Kyanite.

367. Which one of the following is a radioactive ore?

(a) Carnotite (b) Scheelite
(c) Tremolite (d) Wiilfenite

368. Which one of the following is an important ore for Aluminum metal?

(a) Brucite (b) Bauxite
(c) Braunite (d) Borax

369. What is common among the following ores: Gypsum, Epsomite, Chalcanthite and Mirabilite.

(a) All are radioactive ores. (b) All are ores for Iron metal
(c) All are sulphates chemically (d) All are metamorphic in nature.

370. Which of the following ores is exported by Pakistan?

(a) Dolomite and Borax. (b) Gypsum and Chromite
(c) Wolframite and Bauxite (d) Carnotite and Bauxite.

371. Copper is considered as one of the oldest metal and it is known since 4000 B.C. Copper is largely distributed in rocks, soil and sea. Which one of the following ores of copper is chemically copper oxide?

(a) Chalcopyrite (b) Cuprite
(c) Azurite (d) Chalcocite.

372. Where are copper ores found in Pakistan?

(a) In Punjab (b) In Sindh
(c) In KPK. (d) In Balochistan.

373. Bauxite is an important ore for Aluminum which is extracted by Hall process. Which of the following countries is rich in Bauxite deposits?

(a) Australia (b) Brazil
(c) France (d) All the above.

374. Which one of the following is the most important ore of Iron?

(a) Hematite (b) Limonite
(c) Magnetite (d) Siderite.

375. Corundum is the second hardest mineral known after diamond. What is its chemical composition?

(a) Aluminum Sulphate (b) Aluminum Carbonate
(c) Aluminum Chloride (d) Aluminum Oxide.

376. Which one of the following is not a clay mineral?

(a) Bentonite (b) Biotite
(c) Illite (d) Kaolimite.

377. Which one of the following is an ore for Uranium:

(a) Carnallite (b) Carnotite
(c) Crocoite (d) Calcite

378. Zinc is a shining white metal with-bluish-gray luster. It does not occur free. Which one of the following is not an ore for zinc?

(a) Franklinite (b) Epsomite

(c) Smithsonite (d) Wurtzite.

379. Tungsten is a hard, brittle gray solid. It has the highest melting point (3410°C) of all the metals. Which one of the following is an important ore of Tungsten.

(a) Wolframite (b) Dolomite
(c) Chromite (d) Brucite

380. Vanadium is a silvery-white ductile metal. It is used for the manufacture of alloy steels. Which one of the following is an ore for Vanadium?

(a) Patronite (b) Vanadinite
(c) Roscoelite (d) All the above.

381. Piezoelectricity was discovered by Pierre and Jacques Curie in 1880. They discovered that pressure on a quartz crystal causes positive and negative charges to be produced across the crystal. It was later found that an alternating electrical charge placed on a piezoelectric crystal could cause the crystal to vibrate. This is the basis of the use of quartz as Oscillator plates to control radio waves and keep time. How were these two discoverers related?

(a) They were sisters (b) They were brother and sister.
(c) They were brothers (d) There were son and father.

382. Precious minerals are called gemstones. Gemstones have been a source of delight and fascination for many thousands of years. Which of the following is not an example of a gemstone?

(a) Ruby (b) Emerald
(c) Diamond (d) Calcite

383. Ideally gemstones should be hard and unaffected by the temperatures, pressures, abrasive dusts and chemicals encountered in daily life. The majority of gemstones are chemically:

(a) Oxides (b) Sulphate
(c) Carbonates (d) Silicates

384. Which gemstone is made up of a single element?

(a) Sapphire (b) Diamond
(c) Topaz (d) Emerald.

385. Which diamonds are the most precious and rare?

(a) Colourless (b) Yellow coloured
(c) Red coloured (d) Blue coloured.

386. What is the usual unit of weight measurement for gems?

(a) Grams (b) Milligrams
(c) Carats (d) Ounces.

387. How many carats make a gram?

(a) 5 (b) 10
(c) 2 (d) 3

388. A constant mathematical relationship exists between the angle at which light strikes a mineral and angle of refraction — this is called the refractive index. This physical

property gives brilliance to gemstones. What is the value of refractive index for diamond?

(a) 1.33 (b) 1.55

(c) 2.41 (d) 3.14

389. Ruby and Sapphire are beautiful gemstones. Their chemical composition is aluminum oxide. Which of the following countries is famous for these gems?

(a) Thailand (b) Sri Lanka

(c) Tanzania (d) Zimbabwe.

390. Emerald is beryl mineral. Its crystal structure is hexagonal and hardness 7.5. What is its usual colour?

(a) Red (b) Blue

(c) Green (d) Purple

391. Name the country in Asia where best quality emeralds are mined?

(a) India (b) Pakistan

(c) Sri Lanka (d) Maldives

392. Opal occurs in two distinct varieties — precious opal and common opal. Both varieties are cut as gemstones but only precious opal displays the rainbow iridescence so highly prized in jewellery from Roman times onwards. Where is it mined most?

(a) Australia (b) Mexico

(c) Czechoslovakia (d) In all the above.

393. Agate and Jasper are the chameleons of the gem world, displaying a bewildering variety of suble-colours and patterns. What is their chemical composition?

(a) Aluminum oxide (b) Silicon dioxide

(c) Zinconium oxide (d) Chromium oxide.

394. Topaz is a very hard gemstone. Its usual colours vary from golden — brown to pink. What is its chemical composition?

(a) Aluminum silicate (b) Aluminum sulphate

(c) Aluminum oxide (d) Aluminum carbonate

395. The word Diamond is derived from the Greek word adamas, meaning "unconquerable" given to the stone because of its supreme hardness. Diamond is made of pure carbon and has an immensely strong crystal structure. Which country is the top producer of diamonds?

(a) Pakistan (b) Brazil

(c) Australia (d) U.S.A.

396. The Koh-i-Noor is claimed to be the oldest large diamond. It was first presented to Mughal Emperor Babur in 1526. When was this later presented to Queen Victoria?

(a) 1820 (b) 1830

(c) 1840 (d) 1850

397. Which one of the following is a famous diamond?

(a) Koh-i-Noor (b) Blue Hope

(c) Premier Diamond (d) All the above

398. Plants and animals were our earliest sources of ornaments. These are called organic gems. Name some gemstone synthesied by living organisms:
(a) Amber (b) Jet
(c) Pearl (d) All the above.

399. Which one of the following organic gems is pure calcium carbonate?
(a) Pearls (b) Corals
(c) Shells (d) Jets

400. Artificial gems are as popular as the original ones. These are cheaper and easily available. In appearance, they look like real but are very different in compositions. What name is given to the man-made gems?
(a) Imitations (b) Composite stones
(c) Synthetics (d) All the above.

401. Physics is one of the oldest physical sciences previously known as Natural Philosophy. Physics is a science of measurements dealing with properties of matter and energy. Who got the first Nobel Prize in Physics?
(a) P. Zeeman (b) W. C. Roentgen
(c) W. H. Bragg (d) E. Fermi

402. The subject of Physics is classified into various Sub-disciplines. "Which one of the following is the most developed branch of physics now-a-days?
(a) Spectroscopy (b) Nuclear Physics
(c) Quantum Mechanics (d) Electronics.

403. The microscope is an instrument for producing enlarged images of objects that are too small to be seen by the eye unaided. Microscope may be simple or compound. But the most modern version of microscope is the Electron Microscope. Who built it first?
(a) Max Knoll and Ernst Ruska
(b) H. Binning
(c) Robert Millikan
(d) Anton Van Leeuwenhoek.

404. Galileo made the first ever astronomical telescope some 400 years ago. The Rubble Space Telescope is the greatest scientific achievement of the 20th century it is the most modern version of telescopes. When was the Hubble Space Telescope launched by NASA into the Earth's orbit?
(a) April 10, 1990 (b) March 10, 1990
(c) May 10, 1990 (d) June 10, 1990

405. Who detected the radio-waves first?
(a) Nicola Tesla (b) Heinrich Hertz
(c) Perkin (d) J. C. Maxwell

406. Who discovered Artificial Radioactivity?

(a) Henri Becquerel
(b) Pierre Curie
(c) Marie Curie
(d) Frederic Joliot Curie.

407. Name the woman scientist who won the Nobel Prize twice.

(a) Marie Curie
(b) Dorothy Hodgkins
(c) Tony Morrison
(d) Barbar Maclintock

408. One important element found in the nuclear waste is Plutonium. What is its half-life?

(a) 200 days
(b) 100 years
(c) 2000 years
(d) 24,000 years

409. Name the most fundamental basic constituents of matter according to the latest experiments made available?

(a) Electrons and Protons
(b) Protons and Neutrons
(c) Fermions and Bosons
(d) Electron and Neutrons.

410. Until recently protons and neutrons were thought to be fundamental particles of matter but not any longer. It is now established that protons and neutrons are composed of Quarks. Which of the following informations is correct in this connection?

(a) A proton is composed of two up-quarks and one down-quark.
(b) A neutron is composed of one up-quark and two down-quarks.
(c) Quarks are observed to carry a fraction +2/3 or −1/3 of the electric charge of the proton.
(d) All the above are correct.

411. There are mainly four types of forces found in nature namely; Strong forces, Gravitational forces, Electromagnetic forces and Weak forces. Name the basic particles that mediate these four forces.

(a) Bosons
(b) Means.
(c) Neutrinos
(d) Protons.

412. Electrons are negatively charged particles and are essential part of all atoms. Electrons continue to remain indivisible uptil now. All experiments have, failed to resolve them further. Electrons belong to which class of particles?

(a) Quarks
(b) Leptons
(c) Hadrons
(d) Fermions

413. The Pakistani physicist Dr. Abdus Salam shared Prize with Steven Weinberg and Sheldon Glashow for his contributions in the exploration of Nature basic forces. In which year he was awarded the Nobel Prize in Physics?

(a) 1977
(b) 1979
(c) 1978
(d) 1980

414. Karachi Nuclear Power Plant (KANUPP) was Pakistan's first nuclear power plant set up at Karachi, now it is to be decommissioned soon. Second nuclear power plant is in the process of making at Chasma. Chinese and Pakistani teams of engineers and workers are busy working for the Chasma. Nuclear Power Plant (CHASHNUPP) which is situated at about 160 Km north-east of Islamabad in the Mianwali District What is the energy capacity of this plant?

(a) 50 Megawatt (b) 100 Megawatt
(c) 200 Megawatt (d) 300 Megawatt

415. What is the total installed capacity of Karachi Nuclear Power Plant?

(a) 125 Megawatt (b) 200 Megawatt
(c) 50 Megawatt (d) 100 Megawatt.

416. Which one of the following nuclear fuels is now more commonly used in the nuclear reactors?

(a) Uranium (b) Plutonium
(c) Thorium (d) Lithium

417. The Hub Power Project in Pakistan is sponsored by Xenel of Saudi Arabia and a host of other multinationals. It is one of the biggest power projects in Asia and is considered to be a trial blazer for other private project in the region. About how much energy would be produced by this project?

(a) 300Megawatt (b) 600 Megawatt
(c) 900Megawatt (d) 4200 Megawatt

418. Which one of the following fuels is used in a modem submarine?

(a) Nuclear fuel (b) Petrol
(c) Diesel (d) Coal.

419. Which one of the following fuels is most likely to be employed as major fuel in the near future?

(a) Wood (b) Diesel
(c) Methane (d) Hydrogen

420. Which country in the world is the biggest consumer of energy?

(a) U.S.A (b) Russia
(c) Canada (d) France

421. Short-waves have the remarkably property of being able to cover great distances by using an invisible layer in the upper atmosphere to bounce radio signals back and fourth to reach the Earth. What is the normal range of short waves?

(a) 1-10 meters (b) 10-100 meters
(c) 100-200 meters (d) 200-300 meters.

422. Lever is defined as a rigid bar that may be turned freely about a fixed point of support, the fulcrum. Levers help in getting mechanical advantage. Give some example of appliance using the principle of lever.

(a) Claw-hammer (b) Tower-crane

(c) See saws (d) All the above.

423. Pulley is a wheel (grooved or otherwise) that turns on an axis and carries belt or rope on its rim; used for lifting weights or changing direction of pull or transmission of power. Which appliance uses pulleys?

(a) Crane (b) Electric motor

(c) Bicycle (d) All the above.

424. Accidents at nuclear power plants continue to remain a threat for the mankind and speak of the need to build even safer reactors. Name a plant where such an accident has occurred in the last decade.

(a) Chernobyl (b) Three mile Island

(c) Mihama (d) All the above.

425. Which part of the human body is likely to be affected first by exposure to nuclear radiations?

(a) Bone marrow (b) Blood

(c) Eyes (d) Kidneys

426. What is meant by Rectilinear Propagation of light?

(a) Light bends round the corners.

(b) Light travels in a straight line.

(c) Light travels faster than sound.

(d) Light is polychromatic in nature.

427. Lenses are used in cameras, telescopes and other instruments to refract and to focus rays of light. Lenses in spectacles help people with poor eyesight to see better. Name the lenses which are thicker in the middle than at the edges.

(a) Diverging lenses (b) Concave lenses.

(c) Convex lenses (d) None of the above.

428. Who built the first nuclear reactor the "Atomic Pile"?

(a) Enrico Fermi (b) Otto Hahn

(c) Freeman Dyson (d) Neil Bohr

429. Name the person who first worked out the principles of Rocket.

(a) Hermann Oberth (b) Konstantin Tsiolkovsky.

(c) Nicolo Tesla (d) Henry Kremer.

430. Nuclear fusion is responsible for the source of in stars. Who first proposed this idea?

(a) Albert Einstein (b) Michael Faraday

(c) Hans Bethe (d) Bertrand Russel.

431. Who devised an equipment to measure an electron?

(a) Robert Millikan (b) James Chadwick

(c) A. H. Compton
(d) William Bragg.

432. Name the country where most powerful Electron Microscope is installed?

(a) Germany
(b) Japan
(c) U.S.A
(d) Russia

433. The principle of the working of an electric bell is:

(a) Demagnetisation
(b) Electromagnetic Induction
(c) Magnetisation
(d) Electrochemical reaction.

434. What is the basic raw material of the nuclear industry?

(a) Uranium
(b) Thorium
(c) Lithium
(d) Plutonium

435. On what principle does the Radar work?

(a) Doppler effect
(b) Radio-reflection
(c) Zeemann effect
(d) Raman effect

436. Atomic clocks give very precise time. What is the principle behind the working of atomic clocks?

(a) Piezoelectric effect
(b) Seeback effect
(c) Peltier effect
(d) Thomson effect.

437. Electric motor is an essential part of all industries. Which principle explains the working of an electric motor?

(a) Lenz's Law
(b) Faraday's Laws of Electromagnetic Induction.
(c) Ohm's Law
(d) Fleming's rule.

438. Energy is the capacity to do work. Which of the following is the most convenient form of energy to use?

(a) Potential energy
(b) Kinetic energy
(c) Electrical energy
(d) Chemical energy.

439. The rate at which work is done is called:

(a) Force
(b) Pressure
(c) Power
(d) Push.

440. Energy can neither be created nor destroyed but it can change into different inter-convertible forms under different conditions. What is the energy change in Electrochemical Cells?

(a) Thermal to electrical
(b) Chemical to electrical
(c) Mechanical to electrical
(d) Nuclear to electrical

441. What is the energy change in generators?

(a) Thermal to Electrical
(b) Light to Electrical
(c) Mechanical to Electrical
(d) Nuclear to Electrical

442. What is the energy change in Photosynthesis?

(a) Light to chemical (b) Kinetic to Radiation

(c) Thermal to Electrical (d) Chemical to Thermal.

443. What is the energy change in thermocouples?

(a) Light to Chemical (b) Thermal to Electrical

(c) Kinetic to Potential (d) Electrical to Mechanical.

444. Laser is coherent, concentrated and a single frequency light. Laser light finds a lot of application in daily life. Who invented Laser?

(a) Lord Kelvin (b) T.H. Mainman

(c) Smile Bandot (d) William Shockley

445. Laser light is used in the technique of Holography. What is Holography?

(a) Three dimensional caustics

(b) Three dimensional photography

(c) Three dimensional surveying

(d) Three dimensional range-finding.

446. Laser light is used in eye-surgery. Which part of the eye is welded with laser?

(a) Cornea (b) Iris

(c) Pupil (d) Retina.

447. Sounds are produced when an object vibrates. When this happens, the air around the object also vibrates. These vibrations in the air travel as sound waves. How many times light travels faster than sound?

(a) 800,000 (b) 900,000

(c) 700,000 (d) 600,000

448. Semiconductor is a material that conducts electrical current less easily than does a metal but much better than an insulator. Which one of the following elements is a semiconductor?

(a) Silicon (b) Germanium

(c) Selenium (d) All the above.

449. Which one of the following compounds is not a semiconductor?

(a) Gallium arsenide (b) Lead telluride

(c) Lithium carbonate (d) Indium anti-monide.

450. Semiconductors are doped with selected impurities during crystal growth to achieve desired properties. Which one of the following is a typical impurity in a semiconductor.

(a) Hydrogen (b) Arsenic

(c) Helium (d) Sodium.

451. The shadow formed, when light from a point source strikes an object, is sharp and it outlines accurately the shape of the object. The reason for this observation is that:

(a) Light travels faster than sound.
(b) Light travels in straight lines.
(c) Light is polychromatic
(d) Light bends round corners.

452. Which of the following radiations is not dangerous?

(a) Ultra-violet radiations (b) Infra-red radiations.
(c) Gamma radiations (d) Cosmic rays.

453. Plane surfaces such as metal or glass mirrors; the smooth surface of a lake or river reflect light in regular symmetrical ways. The Periscope instrument is based on the principle of reflection. How many plane mirrors are employed in a Periscope

(a) One (b) Two
(c) Three (d) Four.

454. When the white light of the sun is passed through a triangular prism, it splits up into a band of seven colours — this is called Dispersion of Light. This was first noted by Isaac Newton in:

(a) 1560 A.D. (b) 1660A.D.
(c) 1760A.D. (d) 1860 A.D.

455. Colours can be primary, secondary or complementary. Which one of the following is not a primary colour?

(a) Red (b) Yellow
(c) Green (d) Blue

456. Mixing of green and blue primary colours produces which secondary colour?

(a) Yellow (b) Peacock
(c) Magenta (d) None of the above.

457. Opticians and others speak of the power of a lens which is defined as the reciprocal of its focal length taken in meters. The power of a lens is measured in:

(a) Ergs (b) Diopters
(c) Newtons (d) Nanometers.

458. Solids expand on heating. The coefficient of expansion is a characteristic of a solid and is defined as the fraction of its length which the substance expands when the change of temperature is one degree centigrade. Which of the following substance has the maximum coefficient of expansion?

(a) Aluminum (b) Steel
(c) Copper (d) Brass

459. The expansion of liquids is used in a thermometer to indicate the temperature. Which thermometer is used for measuring low temperatures?

(a) Mercury thermometer (b) Alcohol Thermometer
(c) Toluene thermometer (d) Gas thermometer.

460. Temperatures on thermometers are indicated on Celsius or Centigrade scale for most purposes. It was Celnus who designed this scale. Who was he?

(a) German mathematician (b) Swedish astronomer

(c) English physicist (d) Australian chemist,

461. The strength of a current is measured in:

(a) Coulombs (b) Amperes

(c) Volts (d) Joules

462. Name the fourth physical state of matter.

(a) Liquids (b) Solids

(c) Gasses (d) Plasma

463. Name the lightest part of the atom.

(a) Electron (b) Proton

(c) Neutron (d) Nucleus.

464. Name the heaviest part of the atom.

(a) Proton (b) Neutron

(c) Nucleus (d) Electron

465. Dynamo is an essential part of bicycles. What sort of energy conversion takes place in the dynamo?

(a) Frietional to Thermal (b) Mechanical to electrical

(c) Chemical to electrical (d) Potential to electrical.

466. "The apparent loss in weight of a wholly or partially-submerged body in a fluid is equal to the weight of the fluid displaced by it." What is this statement called?

(a) Newton's law of gravitation (b) Newton's law of motion

(c) Archimede's principle (d) First law of thermodynamics.

467. "To every action there is an equal and opposite reaction." What is this statement called?

(a) Newton's first law of motion.

(b) Newton's second law of motion

(c) Newton's third law of motion.

(d) Snell's law.

468. Ultrasonic sound waves of high frequency are inaudible to human ear. What is this frequency?

(a) 10,000 cycles per second

(b) 11,000 cycles per second.

(c) 12,000 cycles per second (d) 9,000 cycles per second.

469. Why are lightning conductors fixed to tall buildings?

(a) To increase the life of the building,

[redacted]

(b) To control the temperature of the building.

(c) To protect the building from lightning

(d) To protect the building from heat.

470. What is the average weight of the air one carries?

(a) 14.72 lbs per square inch (b) 13,72 lbs per square inch

(c) 12.72 lbs per square inch (d) 11,72 lbs per square inch.

471. Nichrome wire is used for electric heaters, electric-irons and electric radiators. What is it made up of?

(a) It is an alloy of nickel and copper

(b) It is an alloy of nickel and chromium

(c) It is an alloy of Iron and copper.

(d) It is a pure aluminum wire.

472. What is the difference between the atomic mass and atomic number?

(a) The number of electrons (b) The number of protons

(c) The number of neutrons (d) The sum of protons and neutrons.

473. Apparent change in the frequency of a sounding body due to relative motion of body and an observer is called:

(a) Resonance effect (b) Doppler effect

(c) Inductive effect (d) Formation of beats.

474. All those physical quantities which require both magnitude and direction to express them completely are called vector quantities. Which one of the following is not a vector quantity?

(a) Velocity (b) Volume

(c) Acceleration (d) Momentum.

475. A body is said to be in equilibrium when all the forces acting on it produce no change in its state of rest or of uniform motion in a straight line. There are three states of equilibrium. Point out the state of neutral equilibrium in the following cases.

(a) Man sleeping on the floor. (b) Air-filled football

(c) A clown dancing on the rope (d) A person standing on one leg.

476. Machine is an assemblage of parts that transmit forces motion and energy one to another in a predetermined manner. Which of the following terms is important in case of machines?

(a) Efficiency (b) Velocity ratio

(c) Mechanical advantage (d) All the above.

477. The ratio of the useful work done by the machine to the total work done on the machine is called:

(a) Mechanical advantage (b) Effeciency

(c) Velocity ratio (d) Load or resistance.

478. Levers are of three types. Which one of the following is not an example of lever of the second order?

(a) Row of a boat (b) Water pump

(c) Lemon squeezing machine (d) The door.

479. Which of the following is not an example of the lever of first order?

(a) See-saw (b) Water pump

(c) Common balance (d) Forearm.

480. Elasticity is that property of matter whereby it resists any force tending to change its length, volume or shape and by which it tends to recover its original condition when force is removed. Which of the following terms is closely related to elasticity?

(a) Stress (b) Strain

(c) Young's modulus (d) All the above.

481. Which of the following laws holds relationship with Elasticity?

(a) Hooke's Law (b) Pascal's Law

(c) Boyl's Law (d) Charle's Law.

482. Mercury is considered to be the best thermometric substance because it covers wide range of temperatures. What is the boiling point of mercury?

(a) 337°C (b) 347°C

(c) 357°C (d) 360°C

483. Expansion of alcohol is much greater than that of mercury. It is therefore, used for measuring low temperatures. What is the freezing point of alcohol?

(a) −110°C (b) −120°C

(c) −130°C (d) −140°C

484. Mirage is one of the practical examples of:

(a) Reflection of light (b) Critical angle

(c) Magnification (d) Total internal reflection.

485. Diamond looks brilliant in light because of?

(a) Magnification. (b) Low refraction

(c) Total internal reflection. (d) Principal axis.

486. Musical sound produces agreeable or pleasant effect upon the ear. Which of the following terms is not linked with the musical sound?

(a) Pitch (b) Loudness

(c) Quality (d) Beats

487. Which one of the following is an element of earth's magnetic field?

(a) The declination

(b) The dip

(c) The horizontal intensity of Earth's field

(d) All the above.

488. A wire of low resistance which is connected in parallel with the terminals of the galvanometer in order to pass a fraction of the total current through the galvanometer is called:

(a) A shunt (b) A fuse
(c) A joint (d) A terminal

489. Which one of the following processes is not the result of the chemical effect of electric current?

(a) Electroplating (b) Electrotyping
(c) Electrometallurgy (d) Electric heating.

490. Which of the following is a variant of levers?

(a) Fixed pulley (b) Movable pulley.
(c) Wheel and axle (d) All the above

491. Heavy water is used as a moderator in Canadian Nuclear Power Reactors. The moderator slows, or 'moderates'. The speed of the neutrons released during fission of Uranium 235 atoms so that the incidence of fission is increased. One part of heavy water occurs in about how many part of ordinary or light water?

(a) 7,000 parts. (b) 6,000 parts
(c) 5,000 parts (d) 4,000 parts.

492. Ordinary water and heavy water differ in physical and chemical properties.
Freezing point of ordinary water is Oc. What is the freezing point of heavy water?

(a) 1.82C° (b) 2.82C°
(c) 3.82C° (d) 4.82C°

493. The boiling point of ordinary water is 100c. What is the boiling point of heavy water?

(a) 100.42 C° (b) 101.42 C°
(c) 102.42 C° (d) 103.42 C°

494. W.H. Bragg and his son W.L.Bragg shared a Nobel Prize in physics for their work o Analysis of Crystal Structure by X-rays. What was the year?

(a) 1914 (b) 1915
(c) 1916 (d) 1917

495. Superconductor is a material that offers no resistance to electric current J.G Bendnorz and K.A. Muller shared the Nobel Prize in physics for their contribution in "Superconductivity in ceramic materials" What was the year?

(a) 1986 (b) 1987
(c) 1988 (d) 1985

496. What was the nationality of J.G. BeiEidnorz and K.A. Muller?
(a) Germany
(b) France
(c) U.S.A.
(d) Switzerland

497. KG. Wilson of U.S.A. got the Nobel Prize in physics for his work on Theory of critical phenomena in connection with phase transitions. What was the year?
(a) 1980
(b) 1981
(c) 1982
(d) 1983

498. Jerome Friedman got 1990 Nobel Prize in physics for his work on Understanding of Matter the reality of Quarks. What was his native country?
(a) U.S.A.
(b) Germany
(c) France
(d) U.K.

499. Which of the following is a specialized types of microscope?
(a) Ultramicroscope
(b) Infrared microscope
(c) Polarizing microscope
(d) All the above

500. Name the famous Muslim Scientist of 9th century who has contributed richly in the subject of physics.
(a) Abu Ishaq Kindi
(b) Banu Musa.
(c) Al-Jahiz
(d) Ibn Jarni

KEY TO MCQs

1.	(c)	2.	(b)	3.	(b)	4.	(c)	5.	(b)	6.	(c)	7.	(d)
8.	(a)	9.	(b)	10.	(c)	11.	(b)	12.	(a)	13.	(b)	14.	(b)
15.	(c)	16.	(a)	17.	(b)	18.	(a)	19.	(c)	20.	(d)	21.	(a)
22.	(c)	23.	(a)	24.	(d)	25.	(b)	26.	(d)	27.	(a)	28.	(d)
29.	(a)	30.	(c)	31.	(d)	32.	(a)	33.	(a)	34.	(b)	35.	(a)
36.	(d)	37.	(b)	38.	(a)	39.	(b)	40.	(a)	41.	(d)	42.	(c)
43.	(c)	44.	(a)	45.	(b)	46.	(b)	47.	(b)	48.	(b)	49.	(a)
50.	(a)	51.	(a)	52.	(d)	53.	(c)	54.	(a)	55.	(b)	56.	(a)
57.	(d)	58.	(b)	59.	(b)	60.	(d)	61.	(a)	62.	(c)	63.	(c)
64.	(d)	65.	(a)	66.	(a)	67.	(b)	68.	(d)	69.	(d)	70.	(b)
71.	(c)	72.	(d)	73.	(b)	74.	(a)	75.	(d)	76.	(c)	77.	(b)
78.	(a)	79.	(d)	80.	(b)	81.	(a)	82.	(b)	83.	(c)	84.	(d)
85.	(b)	86.	(d)	87.	(d)	88.	(b)	89.	(d)	90.	(d)	91.	(b)
92.	(b)	93.	(a)	94.	(c)	95.	(d)	96.	(a)	97.	(a)	98.	(b)
99.	(c)	100.	(d)	101.	(d)	102.	(d)	103.	(c)	104.	(b)	105.	(d)

106.	(d)	107.	(d)	108.	(b)	109.	(d)	110.	(c)	111.	(c)	112.	(c)
113.	(d)	114.	(b)	115.	(a)	116.	(b)	117.	(b)	118.	(a)	119.	(b)
120.	(d)	121.	(d)	122.	(a)	123.	(b)	124.	(d)	125.	(b)	126.	(a)
127.	(d)	128.	(a)	129.	(b)	130.	(a)	131.	(b)	132.	(c)	133.	(c)
134.	(a)	135.	(b)	136.	(d)	137.	(a)	138.	(c)	139.	(b)	140.	(c)
141.	(d)	142.	(d)	143.	(c)	144.	(b)	145.	(d)	146.	(c)	147.	(b)
148.	(a)	149.	(b)	150.	(c)	151.	(a)	152.	(d)	153.	(b)	154.	(c)
155.	(d)	156.	(c)	157.	(d)	158.	(a)	159.	(b)	160.	(a)	161.	(c)
162.	(a)	163.	(d)	164.	(c)	165.	(d)	166.	(a)	167.	(b)	168.	(a)
169.	(c)	170.	(b)	171.	(a)	172.	(c)	173.	(b)	174.	(d)	175.	(c)
176.	(c)	177.	(b)	178.	(b)	179.	(a)	180.	(d)	181.	(d)	182.	(c)
183.	(b)	184.	(d)	185.	(a)	186.	(b)	187.	(a)	188.	(b)	189.	(c)
190.	(b)	191.	(a)	192.	(b)	193.	(c)	194.	(a)	195.	(b)	196.	(b)
197.	(c)	198.	(d)	199.	(a)	200.	(a)	201.	(b)	202.	(a)	203.	(c)
204.	(c)	205.	(d)	206.	(b)	207.	(c)	208.	(b)	209.	(d)	210.	(c)
211.	(b)	212.	(c)	213.	(b)	214.	(d)	215.	(d)	216.	(c)	217.	(b)
218.	(c)	219.	(d)	220.	(b)	221.	(c)	222.	(b)	223.	(c)	224.	(c)
225.	(a)	226.	(b)	227.	(b)	228.	(d)	229.	(c)	230.	(b)	231.	(b)
232.	(b)	233.	(d)	234.	(b)	235.	(c)	236.	(a)	237.	(b)	238.	(b)
239.	(d)	240.	(c)	241.	(c)	242.	(a)	243.	(b)	244.	(d)	245.	(c)
246.	(c)	247.	(c)	248.	(a)	249.	(b)	250.	(b)	251.	(b)	252.	(c)
253.	(b)	254.	(d)	255.	(c)	256.	(a)	257.	(d)	258.	(a)	259.	(c)
260.	(d)	261.	(d)	262.	(c)	263.	(c)	264.	(a)	265.	(b)	266.	(a)
267.	(d)	268.	(c)	269.	(b)	270.	(c)	271.	(a)	272.	(b)	273.	(a)
274.	(b)	275.	(a)	276.	(b)	277.	(c)	278.	(b)	279.	(a)	280.	(a)
281.	(a)	282.	(b)	283.	(b)	284.	(c)	285.	(c)	286.	(a)	287.	(c)
288.	(a)	289.	(b)	290.	(a)	291.	(d)	292.	(c)	293.	(b)	294.	(d)
295.	(d)	296.	(a)	297.	(d)	298.	(a)	299.	(b)	300.	(c)	301.	(b)
302.	(d)	303.	(b)	304.	(a)	305.	(c)	306.	(a)	307.	(c)	308.	(b)
309.	(a)	310.	(b)	311.	(d)	312.	(c)	313.	(d)	314.	(a)	315.	(d)
316.	(b)	317.	(a)	318.	(d)	319.	(d)	320.	(a)	321.	(d)	322.	(b)
323.	(a)	324.	(d)	325.	(c)	326.	(c)	327.	(c)	328.	(d)	329.	(c)
330.	(d)	331.	(b)	332.	(a)	333.	(c)	334.	(a)	335.	(b)	336.	(d)

337. (b)	338. (b)	339. (d)	340. (d)	341. (d)	342. (c)	343. (a)
344. (b)	345. (c)	346. (c)	347. (d)	348. (d)	349. (d)	350. (b)
351. (d)	352. (a)	353. (d)	354. (c)	355. (b)	356. (b)	357. (d)
358. (a)	359. (d)	360. (d)	361. (c)	362. (b)	363. (d)	364. (b)
365. (c)	366. (a)	367. (c)	368. (b)	369. (b)	370. (a)	371. (b)
372. (d)	373. (c)	374. (a)	375. (d)	376. (b)	377. (c)	378. (b)
379. (d)	380. (b)	381. (a)	382. (c)	383. (a)	384. (b)	385. (d)
386. (b)	387. (d)	388. (a)	389. (b)	390. (d)	391. (c)	392. (c)
393. (d)	394. (d)	395. (d)	396. (d)	397. (c)	398. (d)	399. (c)
400. (a)	401. (b)	402. (d)	403. (a)	404. (a)	405. (b)	406. (d)
407. (a)	408. (d)	409. (c)	410. (d)	411. (a)	412. (b)	413. (b)
414. (d)	415. (a)	416. (b)	417. (d)	418. (a)	419. (d)	420. (a)
421. (b)	422. (d)	423. (d)	424. (d)	425. (a)	426. (b)	427. (c)
428. (a)	429. (b)	430. (c)	431. (a)	432. (b)	433. (b)	434. (a)
435. (b)	436. (a)	437. (b)	438. (c)	439. (c)	440. (b)	441. (c)
442. (a)	443. (b)	444. (b)	445. (b)	446. (d)	447. (b)	448. (d)
449. (c)	450. (b)	451. (b)	452. (b)	453. (b)	454. (b)	455. (b)
456. (b)	457. (b)	458. (a)	459. (b)	460. (b)	461. (b)	462. (d)
463. (a)	464. (c)	465. (b)	466. (c)	467. (c)	468. (c)	469. (c)
470. (a)	471. (b)	472. (c)	473. (b)	474. (b)	475. (b)	476. (d)
477. (b)	478. (b)	479. (d)	480. (d)	481. (a)	482. (c)	483. (c)
484. (d)	485. (c)	486. (d)	487. (d)	488. (a)	489. (d)	490. (d)
491. (a)	492. (c)	493. (b)	494. (b)	495. (b)	496. (d)	497. (c)
498. (a)	499. (d)	500. (a)				

QUESTIONS & ANSWERS

Q. **What is a shooting star?**

Ans. A shooting star is a meteor that comes from space, burning out in the Earth's upper atmosphere.

Q. **About how many stars can you see on a really clear night with the naked eye?**

Ans. The total number of star visible with the naked eye cannot be more than 6000 — but it is seldom possible to see more than 2500 at any one time, since faint stars near the horizon are bound to be lost.

Q. **How is twinkling of Stars? Explain.**

Ans. Stars twinkle for two main reasons. The intensity of brightness of the stars decreases and increases because of line-of-sight effect. Moreover, there are disturbance in the gases of the atmosphere around the Earth. Different layers of gases also have different temperature which bring visual changes.

Q. **What is Orion Nebula?**

Ans. The Orion Nebula, as seen from the Earth, is a star forming cloud about 1,600 light years away. Ultraviolet light from the hot, young stars ionizes the gas in the nebula, causing it to glow.

Q. **Which planet in our Solar System has beautiful rings around it?**

Ans. It is the Saturn planet. The celebrated rings of the giant Saturn are composed of thousands of rippling, spiraling bands from 6 to 60 miles in width.

Q. **What is Oort Cloud?**

Ans. It is a reservoir of comets outside the solar system.

Q. **What is the difference between a star and a planet?**

Ans. Star is self luminous heavenly body while planet is rocky-luminous body. Planets, however reflect light.

Q. **What are auroras?**

Ans. These are Northern Polar lights which are caused by electrified particles sent out by the Sun. These charged particles from the sun cascade down into the Earth's upper air. Being charged, they are attracted to the magnetic poles, which is why auroras are best seen from higher latitudes. They are particularly common around the peak of the sunspot cycle. This phenomenon occurs in the thermosphere about 65 miles above sea level.

Q. **Why does a total Solar Eclipse can happen only at the time of the new Moon?**

Ans. A total Solar Eclipse — a situation when the bright surface of the Sun is fully covered by the Moon — can happen only at the new Moon, when the Earth, Moon and Sun are lined up with the Moon between the other two, its night-side turned towards us.

Q. **Why do we see hut only one face of the Moon always?**

Ans. Because, the period of rotation of the Moon is equal to its period of revolution around the Earth. It is also called the synchronous rotation of the Moon which keeps the same face towards the Earth.

Q. **Name some craters on the Mercury?**

Ans. Beethoven. Chopin, Goethe and Ibsen are the craters on the Mercury.

Q. **What is the average temperature variation on the surface of the Moon?**

Ans. The average temperature on the surface of the Moon ranges from -180°C to 100°C. These extreme temperatures appear because there is no atmosphere around the Moon.

Q. **Is the Earth closer to the Sun in January or in July?**

Ans. The Earth is about three million miles closer to the Sun in January — but the seasons are due to the tilt of the axis, the centre of the Earth's rotations, and not to our changing distance from the Sun.

Q. **Which month of the calendar year can lack a new Moon?**

Ans. It is February. The interval between successive new Moons is $29^{1/2}$ days and there are only 28 days in February — 29 in leap year so there might not be a new moon during this month.

Q. **What will be the colour of the sky if viewed from other planets?**

Ans. If you look at the sky from the Moon, it appears completely black because the Moon has no atmosphere. From Mars — it appears organic red because the planet is wrapped in a thin atmosphere of carbon dioxide gas.

Q. **Explain the blue colour of the sky if viewed from other planets.**

Ans. Actually there is no colour of the Sky —but it is the blue part of the white light of the sun which gets scattered by the dust particles hanging in the atmosphere. This is called the Tyndal Effect.

Q. **Why does the Sun appear organic-red at the time of sunrise or sunset?**

Ans. At sunrise and sunset, we see the Sun through a greater thickness of air because it is low in the sky. The colours of the spectrum are gradually scattered. Red and orange are the last to be scattered through the atmosphere around us and therefore the Sun appears organic — Red.

Q. **What is a Rainbow and how it is formed?**

Ans. A rainbow is the appearance of the band of seven colour spectrum on the horizon. Although the Sunlight appears to be white but it is really made of different colours. A rainbow is formed when this white light gets dispersed by passing through million of falling spherical raindrops which act as series of prisms.

Q. **What is an Early Bird?**

Ans. It is the name of the first commercial communication satellite which was launched by U.S.A. in 1965.

Q. **Is our Earth a perfect sphere?**

Ans. The Earth is not a true sphere —but an oblate spheroid, because it s flattened at the poles and bulges out at the equator It is m ire like an orange than like a ball It circumference is 25,000 miles. The polar diameter of the Earth is 26 miles shorter than the equatorial diameter.

Q. **Name the two most abundant elements in the Earth's crust.**

Ans. Oxygen and Silicon are the two most abundant elements present in the Earth's crust.

Q. **Which day of the year is the longest in the Northern Hemisphere?**

Ans. It is the 21st June of every year — it is the time of summer Solastice.

Q. Which countries can experience 6 months day and 6 months Night?

Ans. The Sun rises at the North Pole on the 21st March and this pole remains in light till the 23rd of September. We can see the Sun even at night for some months at places near North Pole like Norway, Greenland and Northern Russia.

Q. Name some calendars which have been used by different people of the world from time to time?

Ans. Julian, Gregorian, Chinese, Jewish and Muslim calendar.

Q. How fast does light travel?

Ans. It travels at a speed of 1,86,000 miles per second in air and it can travel around the world seven and a half times in one second.

Q. What s Greenwich?

Ans. It is the name of a place located on south bank of the River Tames and it is borough of Greater London.

Q. What is Greenwich Mean Time?

Ans. Greenwich Mean Time was established in 1884. The Greenwich meridian is used to measure time zones for the world-. The Earth is divided into 23 full time zones and two half zones. Each full zone is 15° longitude wide and each half zone is 7½ longitudes wide.

Q. What Volcanoes are the most common in the world?

Ans. The Volcanoes of Hawaii are probably the most common and thoroughly studied in the world. They are helping scientists to get a better understanding of how volcanoes on Earth, and on other planets operate.

Q. Name some famous Meteor Craters on the surface of the Earth?

Ans. One of the most famous and the freshest impact crater on Earth is the Arizona's (U.S.A). Meteor Crater. About fifty thousand years ago, a 300,000 ton piece of nickel-iron punched a hole, three quarters of a mile across in Arizona-Colarado Plateau, One of the largest and oldest craters lies on the West side of Ungava Peninsula in Northern Quhec (Canada). It is 2 miles in diameter and 1,200 feet deep.

Q. What is the total volume of the liquid water on the surface of the Earth?

Ans. There is about 340 million cubic miles of liquid water on the surface of the Earth.

Q. Name some countries through which the Equator passes?

Ans. Borneo, Sumatra, Kenya, Uganda, Brazil, Colombia and Equadore.

Q. Give the Latitude, Longitude and Altitude of the City of Lahore.

Ans.

Latitude	32°(N)
Longitude	74°(E)
Altitude	213 metres (698 feet)

Q. Give the Latitude Longitude of Pakistan?

Ans.

Latitude	30°(N)
Longitude	67°, 30 (E)

Q. What is the Dead Sea?

Ans. The Dead Sea is the World lowest sea. Its surface is 400 metres below the Mediterranean.

Q. **Name the four main Mountain Ranges of the World?**

Ans. The four main Mountain Ranges of the World are Himalyan (Asia), Alpine (Western Europe), Rocky (U.S.A.) and Andes (South America).

Q. **Name some Top Resorts of the Caribbean?**

Ans. Virgin, Antigua, Barbados, Grenad, Dominican and Peter Islands.

Q. **What is Golden Triangle?**

Ans. It is a lawless border area in Southeast Asia touching Thailand, Laos and Myanmar where warlords fight for control of drug routes.

Q. **What is Bermuda Triangle?**

Ans. This is the name given to a triangular area of the Western Atlantic Southeast coast of the United States, extending from Bermuda in the north to southern Florida, and then north to a point through Bahamas past Puerto Rico to about 40° west longitude and then back again to Bermuda. This area has occupied a disturbing and almost unbelievable place in the world's catalogue of unexpected mysteries. It continues to remain a saga of unexplained disappearances.

Q. **How many Tectonic Plates make the Earth's dynamic crust?**

Ans. There are 15 main tectonic Plates which make the dynamic crust of the Earth. San Adreas Fault appears along the length of California where North American and Pacific plates meet. Continental drift is now explained in terms of plate tectonics.

Q. **What is an Epicenter?**

Ans. It is a term used in the investigation of Earthquakes and it is described as the centre of the emergence of Seismic Waves which extend in all directions during an Earthquake.

Q. **What is meant by the Richter scale?**

Ans. The severity of an Earthquake is measured by a scale called the Richter scale. This scale is logarithmic in nature, so each addition point represents a tenfold increase in severity.

Q. **What is Atmospheric Pressure? Give its different units?**

Ans. It may be defined as the pressure which the atmosphere exerts on the surface of the Earth at sea-level and 0°C. It is measured by means of an instrument known as Barometer, devised in 1644 by Evangelista Torricilli. Its different equivalent units are:

One Atmosphere = 760 mm Hg
= 760 torr
= $14.696\ 16\ \text{in}^{-3}$
= $1.0132 \times 10^{6}\ \text{dyn cm}^{-2}$
= $1.0132\ \text{Newton m}^{-2}$

Q. **Explain the variation of Atmospheric Pressure with Altitude and its consequences in daily life.**

Ans. The pressure of the atmosphere is not constant all around but it decreases continuously as the altitude is increased. The boiling point of water is 100°C at the pressure often found at sea level. However, at higher altitudes the pressure is less and therefore the boiling point of water is lower than 100°C. People who live where the atmospheric pressure is lower (at high altitudes) must boil foods longer when cooking because water boils at lower temperature. It is due to this reason that people living on mountains feel difficulty in cooking. The idea that pressure affects the boiling point can be used to cook foods quicker by increasing the pressure, special cooking pot called pressure cookers do this.

Pressure in the cooker	Boiling point of water	Elevation	Boiling point of water
760 mm Hg	100°C	0 m	100°c
1010 mm Hg	100°C	1000 m	96.6°C
1260 mm Hg	115°C	2000 m	93.4°C
1510 mm Hg	120°C	3000 m	90.1°C

Q. Differentiate clearly between cyclone, Hurricane and Tornado?

Ans. **Cyclone**: It is a rotary usually funnel shaped atmospheric system having its lowest pressure at the centre and is circulating mass of air and water-vapours. It circulates in anti clockwise direction in the northern hemisphere and reverses its direction in the southern hemisphere.

Hurricane: It is a well defined weather system of wind of more than 74 miles per hour and pronounced rotary circulation at the surface.

Tornado: It is a violently rotating column of air, moving counter clockwise at an estimated speed of about 300 miles per hour.

Q. Name two minerals which are exported by Pakistan?

Ans. Gypsum and common salt.

Q. Give some commercial uses of Gypsum?

Ans. It is used in the manufacture of wall-board, cement, fillers in paper, paint and soil industry.

Q. Name some Gem minerals used in jewellery?

Ans. Topaz, Emerald, Jade, Opal, Sapphire, Garnet, Amethyst and Diamond.

Q. Which area of the World is rich in copper deposits?

Ans. The largest known deposits of copper in the world are found on the northern edge of the Atlama desert in Chile.

Q. Name some naturally occurring and man-made elements.

Ans. Hydrogen, Oxygen, Nitrogen, Sodium and potassium are some examples of naturally occurring elements while Neptunium, Plutonium, Berkelium, Nobelium and Lawerncium are examples of some man-made elements.

Q. How many elements are known in this world?

Ans. The total number of known elements in this world is 109 and these elements are arranged in the Periodic Table to study their properties.

Q. What is dry ice?

Ans. It is solid carbon dioxide at a temperature of –80 °C.

Q. Name the elements which are liquid at room temperature?

Ans. Mercury, Bromine, Gallium, Cesium and Francium.

Q. **Name four elements which are gases?**

Ans. Oxygen, Nitrogen, Helium, Hydrogen and Neon.

Primary Colour

One of the three colours — red, yellow, and blue that cannot be created by mixing other colours.

Complementary Colour

Quite literally, the colour next to another on the colour wheel.

Secondary Colour

A colour made by mixing two primary colours together, red and yellow to get orange, yellow and blue to get green, or red and blue to get purple. The secondary colour depends on the proportion in which you mix the two primaries. For example, if you add more red than yellow, you got reddish orange, and if you add more yellow than red, you get a yellowish orange.

Tertiary Colour

Definition: Neutral colours, such as browns and greys, containing all three primary colours. They're created by mixing either all three primary colours or a primary are secondary colour (secondary colours of course being made from two primaries). By varying the proportions of each primary colour, you create the different tertiary colours.

Iodized Salt

Table salt to which an inorganic iodize compound has been added as a nutritional supplement to prevent goiter.

Q. **Differentiate clearly among Energy, Force, Work, Power and Pressure?**

Ans. All these terms are sometimes synonymously used by the layman but every term has a separate scientific meaning which is explained as follows:

Energy:

It may be defined as the property of a system that is a measure of its capacity of doing work. It is measured in Joules. Energy can have various forms like heat, light, potential, Kinetic and electrical.

Force:

Force may be defined as Push or Pull. Force is needed to break the inertia of a system. It is measured in Newton.

Work:

It may be defined as the product of force and distance, it is measured in Joules. The amount of work done depends on:

(i) The size of the force which is used.

(ii) The distance through which the object is moved.

Power:

It is the rate of doing work in a unit time. It is the pressure measured in watts and kilowatt (KW). It is the force exerted on a unit area. If a force of one Newton acts on one square metre. It results in pressure of one Pascal.

Q. **Define Newton?**

Ans. Newton is the unit of force. One Newton is the force needed to move one-kilogram mass one metre per second faster every second.

Q. **What is Horse Power?**

Ans. An engine which could do work equal to lifting 550 pounds one foot per second, is said to work at the rate of one horsepower. This unit of power is used in U.K. and U.S.A.

Q. **What is kilowatt-hour? Explain with an example?**

Ans. A 100-watt light bulb lighted for one hour uses 100-watt-hours of electricity. Since the watt-hour is a small unit, another unit is used to 1000 watt-hours. This unit is called a Kilowatt-hour. This much energy used counts one unit in the electric Metre.

Energy Calculations: In a typical example, a Toaster oven uses 800 watts of power for 2 minutes, Energy used is:

$E = \text{power} \times \text{tune}$

$E = 800 \times 2$

$E = 16000 \text{ watt minutes.}$

1600 watt-minutes = 1600 × lkw/1000 w × 1 hour/60 minutes = 0.026 kW of electric energy.

Q. **What is the most popular form of energy?**

Ans. Electricity is the popular form of energy and it is fundamental to modern life. It is a uniquely valuable, versatile and controllable form of energy, which can be asked to perform many tasks efficiently.

Q. **Can we create or destroy energy?**

Ans. Energy may change in form but it cannot be destroyed. A power station does not create the electrical energy that we use in our homes. The power station actually changes the chemical energy of the fuel into electrical energy. When the electricity so produced is used up, it is not destroyed but instead it changes into another form of energy, such as heat or light.

Q. **What organisations are responsible for the supply of electricity in Pakistan?**

Ans. The total installed capacity of the country power network is about 20000 megawatts and is increasing each year. It was 113 MW in 1948.

Q. **What are the electricity production capacities of Mangla and Tarbela Dams?**

Ans. Electricity production capacities of

Mangla Dam = 1200 MW
Tarbela Dam = 2150 MW

Q. **Give the names of the Dams which will be built in future?**

Ans. Bhasha Dam (Capacity: 3,360 MW)
Kalabagh Dam (Capacity 3,600 MW)
Satpara Dam (Capacity 644 Giga Watt hour)

Q. **What are the additional advantages of Hydro-Electric Power Generation?**

Ans. Hydro-electric power means production of electricity by making Dams. Its additional advantages are:

(i) It is cheaper.
(ii) It is pollution free.
(iii) Water can be used for Irrigation purpose.

[redacted]

Q. What is Hub Power Project?

Ans. To overcome the power crises in the country, a private Power cell has been established to explore and engage additional resources in the power generation. It is now working on the Hub Project. It will carry a generation capacity of 1200 MW.

Q. What is a Turbine?

Ans. It is a rotary engine actuated by the reaction or impulses or both of a current of fluid; water or steam. Turbines are most efficient engines. Turbines transform the kinetic energy of water and steam to mechanical energy.

Q. What are Isotopes?

Ans. Each element has its own characteristic number of protons and an equal number of electrons. If you change these numbers, you change the element involved. However, the number of neutrons in the atoms of a given element is able to vary. Atoms that have the same nuclear charge but a different number of neutrons are called Isotopes. Two famous isotopes of Uranium element are Uranium-235 and Uranium-237.

Q. What are the main fissionable materials involved in the production of Nuclear Energy?

Ans. These are Uranium-235 and Plutonium-239. The later is superior to the former as a nuclear fuel.

Q. What is the percentage of Uranium-235 fuel for commercial reactor?

Ans. Commercial reactors are powered by fuel containing 1.6-5.5% Uranium-235. Nuclear submarines use more enriched fuel; 9.3% Uranium-235.

Q. How do you compare Fission with Fusion for the production of Nuclear Energy?

Ans. The process of Nuclear Fusion should be preferred over Fission for the production of Energy for two main reasons. It involves cheaper and abundant raw materials and pollution free waste products.

Q. What is Heavy Water?

Ans. It is deuterium oxide (D_2O). Hydrogen of water molecule is replaced by its heavier isotope. Deuterium. Heavy Water is used as a coolant in nuclear power plants.

Q. How much energy will be produced by the nuclear fission of one gram of Uranium-235?

Ans. It will generate about 2×10^7k Calories of heat. This much heat can be produced otherwise by the combustion of 3 tones of coal. One kilogram Uranium-235 is equivalent in energy content to 18,700 tons of TNT.

Q. What is KANUPP?

Ans. KANUPP Stands for Karachi Nuclear Power Plant — it produces about 0.2% of the total electricity produced in Pakistan.

Q. What is an electric Fuse?

Ans. Homes are protected against overloaded circuits by automatic switches that open whenever the current into the wires becomes dangerously large one of the most common types of automatic switches is called an electric fuse. An electric fuse contains a strip of metal.

Q. What are Circuit Breakers?

Ans. Circuit breakers are now installed in many new homes in place of fuse boxes. A circuit breaker is more convenient than a fuse because the automatic switch can be closed again by pushing a knob.

Q. **What are Windmills?**

Ans. Windmills have been used to produce electricity since the early 1900s. It is easy to produce electricity from a wind generator. This is simply a windmill that converts the kinetic energy of the wind into electrical energy.

Q. **What is Geothermal Energy?**

Ans. It is the utilization of the heat of the Earth. Cold water is pumped through the Earth and is heated up by hot rocks. Another pipe brings the hot water or steam to the surface. The steam comes out at high pressure and is used to drive steam turbines for the generation of electricity.

Q. **What is meant by reprocessing?**

Ans. It is a process in which the fissionable product is recovered from the spent nuclear reaction fuel by chemical dissolution. It generates highly radioactive wastes that must be solidified for final disposal.

Q. **Name some Petrochemicals?**

Ans. Petrochemicals are the substances which are obtained during the refining of crude petroleum. Typical, examples are, Ether, Benzene, Xylene, Toluene and Ethylene.

Q. **Name some fractions from an oil refinery with their boiling points?**

Ans. Some of the fractions from an oil refinery are given below with their boiling points:

Oil factions	Boiling points
Petrol b.pt.	40-75°C
Kerosene b.pt.	125-175°C
Diesel b.pt.	175-250°C
Lubricating oil b.pt.	250-300°C
Bitumen b.pt.	More than 350°C

Q. **What is Biomass?**

Ans. It is source of energy that comes from plants and animals CO_2 and oil are forms of biomass energy, because they come from plants and animals that lived million of years ago. Dried seaweed is an example of biomass. Another example is dried animal dung, which is used in many countries in Africa and Asia as a fuel for cooking.

Q. **What is Energy Conservation?**

Ans. It is the process in which energy is used most efficiently without any wastage in home appliances. It can be done as follows:

(i) By using improvised/compact fluorescent electric bulbs.

(ii) By the efficient use of electricity.

(iii) By leading a simple life.

(iv) By using automated-control systems in appliances. Asia could save billions of US dollars by conserving electricity.

(v) By using light emitting diodes (LEDs)

⇒ Replace fluorescent bulbs with energy Sonex bulbs.

Q. **What is Electromagnetic Energy?**

Ans. The air contains millions of tiny, fast moving particles. Waves of energy pass through the air, too. This kind of energy, called electromagnetic energy is made of vibrations of electricity and magnetism. That is a whole range of different electromagnetic waves.

Q. **Compare the conductivities of Silver, Aluminum, Copper and Iron metals?**

Ans. All these metals are good conductor of electricity; however their conductivity decreases in the following order:

Silver
Copper
Aluminum
Iron

↓ Conductivity decreases

Q. **Name some un-reactive metals?**

Ans. Gold, Silver, Platinum, Copper and Tin.

Q. **What is corrosion? How can this be protected?**

Ans. It is a chemical process in which a metal gets rusted or corroded. A metal gets corroded whenever a chemical attacks its surface. Water, air and acids are three of the most common corroding chemicals. When a piece of metal corrodes, it first loses its shiny surface. Then, as more and more is eaten away, it loses its strength. Metal corrosion is a big problem. Tin is more commonly used for coating metal cans for protection against corrosion. The can is actually made up of steel (which is mostly iron). This makes the can strong and cheap. Moreover, the tin metal protects the steel from being corroded by the food in the can.

Q. **Name some reactive metals?**

Ans. Sodium, Potassium and Magnesium.

Q. **What are noble metals? Give examples?**

Ans. There are certain metals which are very un-reactive and are not corroded at all. These metals are called Noble metals. Typical examples are Silver, Gold and Platinum. These noble metals are used in jewellery.

Q. **What are Alloys? Give their importance?**

Ans. Alloys are usually made by melting two or more suitable metals together, and then allowing the molten mixture to cool down and harden. This is done to get desired properties from the metals. Alloys behave very differently from the mixed metals in properties. Most of the corrosion problems are slowed down using metal alloys. Some famous alloys alongwith their characteristics are described below in the form of a chart:

Q. **In what ways is stainless steel better than Iron?**

Ans. Stainless steel is the best known example of the corrosion resistant alloy. It belongs to the family of steels–alloys of iron with other metals. Iron is alloyed with 10-25% chromium to form stainless steel. This converts the iron which rusts so easily and is quite brittle into a stronger and rust-resistant substance.

NAME OF THE ALLOY	COMPOSITION OF THE ALLOY	SPECIAL PROPERTIES OF THE ALLOY	USES OF THE ALLOY
Corronel	Nickel, Molybednum and Iron.	Very resistant to acids	Reaction Vessels in the Chemical Industry
Solder	Lead and Tin	Low melting and good conductor of electricity	It is used for making connections between electrical Wires
Burma-bright-S	Aluminum, Magnesium and other metals.	Light weight and very resistant to saltwater	It is used in making the upper decks of the ships
Amalcap	Mercury, Silver and Tin.	It can be mixed in cold state and sets hard in 24-hours.	It is used in fillings for teeth.
Nimonic	Nickel and Chromium.	It is not affected by corrosion even at high temperature.	It is used in making Jet engines.
Amalgam	Mercury with Zinc, Sodium or Lithium.	A silver-white porous crystalline mass.	It is used in dental fillings, silvering of mirrors and as catalysts.

Q. **Differentiate clearly between Pig iron, Cast iron, Wrought Iron, Steel and Stainless Steel.**

Ans. Pig Iron, Wrought Iron, Cast Iron, Steel and Stainless Steel are all commercial forms of Iron. Each one is described separately below:

Pig Iron:

In metal terminology "pig" is a bar or ingot of cooled metal. It is the basic raw material for steel and cast iron. It is actually an impure form of iron and contains 1% Silicon, 0.03% Sulphur, 0.27% Phosphorous, 2.4% Magnesium, and 4.6% Carbon and, the rest is iron. It is a product of blast furnace.

Cast Iron:

It is a generic name for a group of metals that basically are alloys of carbon and silicone with iron; it is also an impure form of iron. It contains 2-3% carbon and 1.5% other impurities like silicone, phosphorous, manganese and sulphur.

Wrought Iron:

It is the purest form of iron. Carbon seldom exceeds 0.25% and Manganese content is held at 0.06% maximum. Wrought iron is readily fabricated by standard methods and is quite corrosion resistant.

Stainless Steel:

It is a special alloy of iron with chromium and nickel. These metals greatly increase, their ability for corrosion resistance, it is used in making slip hulls, auto-bodies, machinery and machine parts, cables, abrasives and chemical equipment.

Steel:

It is an alloy of iron and 0.25-2% carbon. It is made from molten pig iron by oxidising out the excess carbon and other impurities.

Q. Differentiate between Brass, Bronze and German silver.

Ans. Brass:

It is an alloy of copper with zinc; copper 80% and zinc 20%. It has two varieties — Red Brass (15% zinc) and yellow Brass (34-37% zinc). It is used for making hose nozzles, oil gauges, air cocks, jewellery and stamping dies.

Bronze:

It is an alloy of copper with tin-copper 90% and Tin 10% special bronze also called aluminum Bronze contains 5-10% aluminum. It is used in making springs, spark-resistant tools, electrical hardware, vacuum driers, blenders and rain cocks.

German silver:

It is an alloy of copper with nickel and zinc. The proportions of these three metals in the alloy can be (2:1:1) or (5:2:2).

Q. Identify the following materials and give their uses?

(i) Feldspar *(ii)* Quartz *(iii)* Mica

Ans.

(i) **Feldspar:** It is one of the mineral which make up granite and it has pink or grey crystals. It is resistant to heat, water and other chemicals. It is used in making porcelain and glazes for pottery.

(ii) **Quartz:** It is a crystalline form of silicon dioxide. It is resistant to heat, chemicals and electricity. It is used in milking pottery and glass.

(iii) **Mica:** It has flat transparent crystals. It is resistant to chemicals. It has high melting point and is an excellent insulator. It is used as an insulator in electric irons. Powdered mica is the snow on greeting cards.

Q. How is pure silicon obtained?

Ans. Pure silicon is obtained by heating silicon dioxide with carbon. It is used to make the chip in the computer.

Q. What is the main use of Limestone?

Ans. It is mainly used in the manufacture of cement.

Q. Name the main Ores of Aluminum, Iron, Tin, Titanium and Gold.

Ans.

Metal	Ore
Aluminium	Bauxite
Iron	Haematite
Tin	Cassiterite
Titanium	Rutile
Gold	Native Gold

Q. What s Doping?

Ans. It is a process in which impurities are added to a semi-conductor to boost up its efficiency. These impurities function as electron donors or acceptors and the semiconductor is designated n-type or p-type depending upon the electrical nature of the "holes" or energy deficits in the crystalline lattice. In the n-type, there is a flow of electrons and Arsenic is an impurity while in the p-type, there is a flow of holes and Boron is an impurity.

Q. **What is Maser?**

Ans. It is microwave amplification by stimulated emission of radiation. Optical maser constitutes laser.

Q. **Who discovered Laser?**

Ans. Gordon Gold discovered Laser in 1957.

Q. **What is function of Ruby in Laser?**

Ans. Ruby is a synthetic material made by the fusion of aluminum oxide and traces of chromium oxide. It is produced by single-crystal growing techniques. It is an important part of a laser machine and is called the medium.

Q. **What is a Hologram?**

Ans. A hologram is a special photograph that appears as three-dimensional picture, it is made by using laser light. The word "hologram" means complete picture.

Q. **What is the importance of Optic Fibres?**

Ans. Optic fibres are made from solid threads of special-glass they can bend without breaking like human hairs. Sound and picture signals are changed into pulses of laser light that travel along these fibres and serve the communication system and in medicine (endoscope). Optic fibers are used to carry radio, telephone, and television and computer data.

Q. **What is Abacus?**

Ans. The Abacus is a simple calculator that has been used for thousands of years. It is still used in some parts of the world today. Calculations are made by moving the beads along the wires.

Q. **Describe a Pantograph?**

Ans. It is an early analogue instrument. It is used for producing larger or smaller copies, or models of plans.

Q. **Define an Integrated Circuit?**

Ans. An integrated circuit is a group of electronic parts joined together in a protective case. Integrated circuits are often called chips, because they are made of thin chips of a material called silicone.

Q. **What is a Byte?**

Ans. In most microcomputers, a Byte is a combination of eight hits. Each Byte represents a numeral, a letter of the alphabet, a punctuation mark or anything else the computer can show. The more bytes a computer can store, the more work it can do. A computer's memory is measured in bytes. A megabyte is 1,048,576 bytes.

Q. **What are mainframes?**

Ans. Mainframes are the largest computers usually found in the head offices of banks and other large companies.

Q. **Name some input devices of the computer?**

Ans. Keyboard, Keypad, Joystick, Mouse, Light pen and modem.

Q. **What is meant by word-processing?**

Ans. Word-processing is a way of using a computer to produce perfectly typed letters or stories when loaded with such a programme. Daisy — Wheel printers do this job.

Q. **Define bar code?**

Ans. It is rectangular set of lines on the packet of a merchandise. These lines are called a bar code. When the cashier passes a laser pen over the bar code, the price appears on the screen.

Q. **What are Radio Waves?**

Ans. Radio waves are electromagnetic radiations made up of electric and magnetic fields vibrating mutually at right angles to each other in space. Radio waves travel with the velocity of light (1,86,000 miles/sec.).

Q. **What is the relationship between wavelength and frequency of radio waves?**

Ans. Wavelength and frequency of radio-waves are held together by the following relationship.

$$f = \frac{c}{\lambda}$$

f = Frequency
λ = Wavelength
c = Velocity of light

Q. **When did Radio Broadcasting Start?**

Ans. Radio Broadcasting started in 1920.

Q. **Name the scientists who played a great role in the development of Radio?**

Ans. Heinrich Hertz, James Maxwell, Michael Faraday and Guglielmo Marconi.

Q. **How is Radio Signal Intensity affected by distance?**

Ans. Radio Signal Intensity, like light intensity decreases as the distance from the source increases.

Q. **How are Radio Waves Generated?**

Ans. Radio waves are generated by using a piezoelectric crystal oscillator.

Q. **What are the essential parts of a radio?**

Ans. The essential parts of a radio are: Vacuum tubes, Transistors, Amplifier and Oscillator.

Q. **Why are short waves more commonly used in the communication system?**

Ans. Short waves have the remarkable property of being able to cover great distances by using an invisible layer in the upper atmosphere to 'bounce' radio signals back and fourth to reach the Earth.

This wave-range (10-100 meters wavelength) is therefore, highly significant for all sorts of telecommunications in widely separated locations.

Q. **Differentiate between Transmitting and Receiving Antennas?**

Ans. The antenna is an essential part of a radio — transmission and reception system. Transmitting antenna is a device that projects the radio frequency generated by a transmitter into space. Antennas have directional properties. The typical outdoor receiving antenna is constructed of several paralleled horizontal metal rods of different lengths spaced one behind the other. Such an array has directional properties, displaying maximum sensitivity on the line at right angles to the metal rods. For local reception, a less elaborate antenna suffices, such as the extendable telescoping rod provided in portable television receivers.

Q. Define Radio Bands?

Ans. The radio frequency spectrum is divided arbitrarily into a number of bands from very low frequencies to super high frequencies?

Q. What is Modulation?

Ans. The process of attaching information to the carrier wave is called Modulation which involves the variation of one of the carrier-frequency characteristics such as its amplitude frequency or its duration.

Q. What is meant by SOS and Mayday calls?

Ans. These are distress frequency Radio signals given out by ships and aircrafts at the time of trouble. SOS calls are given by ships and stand for "save our souls". It is a Morse code signal which started in 1927. Mayday (French: maidez "help me") calls are given by the aircrafts at a frequency of 121.5 megahertz.

Q. What is FM?

Ans. FM stands for Frequency Modulation. It involves varying the frequency of the carrier in accordance with the amplitude of the information signal.

Q. Define Super-heterodyne Principle?

Ans. In most modern radio receivers, reception is base on super-heterodyne principle. The incoming radio frequency is mixed with the output of an oscillation, the frequency of which is adjusted.

Q. What are the essential parts of a Television?

Ans. The essential pails of a Television set are, cathode ray tube or picture tube, scanner or electron beam gun, transistors amplifiers and oscillator.

Q. What is meant by Persistent of Vision?

Ans. Persistent of vision or visual memory is a property of the eye. Motion in the scene is represented by showing a series of still pictures (24/sec.) — this is essential to convey the illusion of motion.

Q. Explain Scanning?

Ans. The scene is broken down into many small pieces called picture elements. The process of breaking down the scene into picture elements and reassembling them on the screen of the television receiver is known as scanning. There are about one hundred thousand picture elements in one scene. The area of a scene is scanned in 1/30th part of a second.

Q. Explain briefly the basic principle of Telephone?

Ans. The basic principle is to use sound vibrations to control a larger source of power and creating a variable resistance in electrical circuit. This is done by making an electric current vary in intensity precisely as air varies in density during the production of sound.

Q. What are the essential parts of a Telephone?

Ans. The essential parts of a telephone; Mouthpiece, Earpiece, Dialing system and complete electric circuit.

[redacted]

Q. Explain briefly the working of a mouthpiece?

Ans. The speaker talks into the mouthpiece, behind which is a transmitter. Vibrating air currents produced by the speech generate vibrations in a thin aluminum diaphragm. These vibrations are transmitted to a small piston, which is the cover for a metallic box filled with small granules of carbon. Electrical contact is made only through the carbon, which is reasonably a good conductor of electricity. Vibrations of the membrane/piston cause the electrical resistance of the carbon grains to vary. This results in variations in the amount of electricity passing through the circuit, and hence through the conducting line.

Q. What is an Earpiece?

Ans. Earpiece is an important part of the telephone at the receiving end. A sound membrane is made to perform vibrations similar to the one induced in the earpiece.

Q. What is the function of dial or Touch-tone?

Ans. The dial or touch-tone of a telephone sends out an electrical code that establishes the correct connection.

Q. Is electricity needed in the working of the Telephone?

Ans. The telephone must operate as a part of complete electric circuit, and so it needs a power source, a conductor and a switch. The power source is a storage battery of about 50 volts.

Q. What are the usual modes of transmission of telephone signals?

Ans. The electrical signals of the telephone are transmitted over long distances in a number of ways e.g. through cables, radio-relays, microwaves and most recently by optical light waves.

Q. Explain briefly the working of a Camera?

Ans. An exposure is made by opening a shutter. Focusing is carried out by varying the distance of the lens from the film by a suitable device. In order to get the correct amount of light, aperture and shutter speeds are controlled.

Q. Differentiate clearly between Aperture and Shutter of a Camera?

Ans. **Aperture:**

An aperture is made of diaphragm. It controls the amount of light entering. The size of the aperture is described by the f-number. In bright light, a small aperture, with a large f-number, should be used.

Shutter:

It makes sure that light only strikes the film when you want to take a photograph. It covers the aperture until you press the shutter releaser, then it opens and closes letting light. Expensive cameras have a shutter speed control. It changes the length of time for which the shutter is open.

Q. Name the essential parts of a camera?

Ans. It essentially consists of light proof box, aperture, shutter, lens and film.

Q. When were lenses invented? Name some appliances that use lenses?

Ans. The Arabs and Chinese knew about lenses around 800 A.D. The appliances which use lenses are glasses, film projectors, cameras, microscopes, telescopes and binoculars.

Q. **What are the essential steps in taking a photograph?**

Ans. The essential steps in taking a photograph are Exposure, Fixing and Positive formation?

Q. **Describe the function of photographic film in a camera?**

Ans. A photographic film is a roll of thin, clear plastic (celluloid) coated with light sensitive chemicals (chemicals which are changed by light). The film is covered with an emulsion of silver bromide. It is converted to metallic silver by the chemical action during developing. Developers produce a black deposit of fine particles of metallic silver on those portions of the film that has been exposed to light thus giving a negative image.

Q. **What is meant by Fixing?**

Ans. It consists of the chemical action of sodium thiosulphate (HYPO) to give water soluble compound which is then washed out with water, leaving a negative free of light sensitive silver salts.

Q. **How is a Positive formed?**

Ans. By placing the finished negative over a piece of sensitive paper similar to film, and exposing to light, the light sensitive silver salts on the paper are affected in a similar way to those in the original film. Those portions of the negative that were darkest let through least light, and thus give the whitest portions on the developed paper. The negative image is thus reversed, and a correct image or photograph is obtained on the paper, which is then fixed and washed with water as before.

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CHAPTER
2

BIOLOGICAL SCIENCES

LIVING THINGS

INTRODUCTION

Matter can be classified into living and non-living things. Living things have life which is a delicate and complex process of genetic material in all cell nuclei. All living things must contain Protoplasm; a material absolutely necessary to perform all functions of life. Protoplasm is the total content of the living cell. Cells are the smallest building blocks of all living organisms which include both plants and animals. All living things contain carbon as an essential element. Characteristics of living organisms are as follows:

1.	**Respiration**	Living organism respires; they inhale and exhale.
2.	**Nutrition**	They need food to provide energy for all life processes.
3.	**Growth**	They increase in weight and size.
4.	**Reproduction**	They produce off-springs which resemble themselves.
5.	**Response**	They are sensitive to internal and external influences or stimuli.
6.	**Excretion**	They yield waste products for disposal.
7.	**Movement**	They are able to move. It is slow in plants.

Life began in oceans millions of years ago and has travelled a long way from sea animals to amphibians, reptiles, birds and mammals. The sciences which deal with living organisms are called Biological Sciences. Some more common biological sciences are described below:

DISCIPLINE

Botany	Branch of Biology that deals with study of plant Kingdom.
Zoology	Branch of Biology that deals with study of animal Kingdom.
Biochemistry	The study of chemical processes of living organisms
Physiology	It deals with functioning of the various organs of living organisms.
Hygiene	It is the science of health and its preservation.
Pathology	It is the science which deals with diseases.

Entomology	It is the branch of Zoology that deals only with insects.
Microbiology	The study of minute living organisms, including bacteria and protozoan.
Cytology	Science dealing with structure and functions of cells and their components.
Histology	Science of organic tissues of animals or plants.
Human Biology	It is the study of life and life supporting processes in human beings.

Classification:

Living organisms show a great diversity in their character. Taxonomy is the branch of biological sciences which put them into different categories of organisms. The classification of animals goes like this — Kingdom, Phylum, Class, Order, Family, Genus and Specie.

THE PLANT KINGDOM

There are nearly half a million species of plants on the Earth. With the exception of few, all of them need three basic ingredients to survive: air, light and water, plants are found in almost every type of habitat. They take their own food using simple raw materials and energy from the Sun. Plants require water to grow. They cannot get this water unless it is available in the soil. Plants obtain water from the soil through their roots. It then passes up the stem to the leaves and flowers. The plant does not take all the water available in the soil. Much of the remaining water evaporates into the surrounding air. The plants can be divided into the following categories:

(i) Non-Green Plants:

This is a group of plants having simple plant body without root, stem and leaves. They do not contain chlorophyll and hence do not involve photosynthesis. They can grow without the aid of sunlight and seem to pop out of the ground overnight. Typical examples of non-green plants are bacteria, fungi and viruses.

(ii) Green Plants:

These are those plants which contain chlorophyll and carry out photosynthesis. There are two categories of green plants: non-flowering and flowering plants.

(a) Non-Flowering Plants (Cryptogams):

These are seedless green plants. They reproduce by means of spores. These plants have existed on Earth for much longer than the flowering plants. Many of them have remained almost unchanged for million of years. They generally have a simple structure and, with the exception of ferns, do not have supporting fiber. This means that they cannot grow to any greater size. Moses, ferns and algae are familiar examples of non-flowering plants.

(b) Flowering Plants (Phanerogams):

These are seed containing green plants. There are two groups of seed plants— the gymnosperms and the angiosperms. This division is based on the type of seeds they have. Gymnosperms have naked or unprotected seeds, while the angiosperms have seed which are protected by a fruit or seed pod. The gymnosperms are the pine, fir, cedar, cypress and spruce tree while the angiosperms include most other trees, the flowering plants, the grasses, crop plants, vegetable and weeds.

PARTS OF A PLANT

The essential parts of a plant are described below:

(i) Flower:

It is that part of a flowering plant which is involved in reproduction. Most flowers have both male and female organs. The male part produces pollens which pollinates the female part. This produces a seed from which a new plant grows.

(ii) Leaf:

A plant's leaves are its food making factories, containing green chlorophyll. They use sunlight, carbon dioxide in the air and water in the soil to make their food. The leaves distribute water from the roots and transport food made in the leaves to the rest of the plant.

(iii) Stem:

This supports the leaves and flowers. It contains xylem and phloem tubes to carry water and food around the plant, and it stores food.

Roots:

These hold the plant in the ground, absorb water and mineral salts from the soil, and in some cases the root is edible.

THE ANIMAL KINGDOM

The animal kingdom consists of about one and a half million species. Animals can be divided simply into two large groups on the basis of external resemblances, homologous features and similarities between them and their development. These groups are Invertebrates and Vertebrates.

1. Invertebrate:

These are those animals which do not posses backbones. These are usually smaller in size but larger in number. About 95 percent of the whole animal kingdom is composed of invertebrate animals. More familiar examples are insects, crabs, worms and spiders. Some of the important families of invertebrate animals are discussed below.

Insects:

Insects have an external skeleton called exoskeleton which provides support and protection. They consist of the head, the thorax and the abdomen, and on the middle part are found three pairs of jointed legs. They are the most numerous and widespread group of animals on Earth. They are found in almost every sort of habitat, from deserts to lakes, and from soil to the air. The most characteristic feature of insects is their ability to fly. Insects eat many different types of food and they have well-developed senses that tell them everything they need to know about their surroundings. Some typical examples of insects are mosquitoes, fleas, grasshoppers, ants, aphid, moth, silverfish, dragonfly and earwing.

Most insects lead independent lives, coming together, with other of their kind only for eating. However, some insects can only survive in complex societies. Ants are interesting social insects which live in large colonies either underground or in loose mounds.

2. Vertebrates:

These are those animals which possess segmental backbone or vertebral column.

Vertebrate animals are generally much bigger in size as compared to invertebrate animals. Animals like cats, dogs, snakes, frogs, birds and fish are familiar examples of vertebrates. Some of the important families of vertebrate animal are discussed below:

(i) Fishes:

Fishes are cold-blooded vertebrate animals whose bodies are covered generally with scales. They are a varied group of animals that have colonized the world oceans, lakes and rivers. They are specially adapted to live and breathe in water, although some can spend limited amounts of time on dry land. Fishes breathe by extracting dissolved oxygen from the water, using a series of internal gills over which water continually passes.

Dolphins and Porpoises:

Dolphins and porpoises are warm-blooded mammals. Over million of years, they developed from land mammals. They are closely related to each other as well as being linked to those other well-known creatures—the great whales. Although they live in the sea, they breathe air. Usually dolphins have beaks and more noticeable dorsal fins than porpoises which are smaller, and their teeth are spade shaped, not pointed like dolphin's teeth. Dolphins are almost as clever as humans.

(ii) Reptiles:

The reptiles are scaly, cold-blooded vertebrate animals which lay eggs with hard, protective shells. They seem to have descended from warmer part of the world. Snakes, crocodiles, tortoises, lizards and alligators are familiar examples of reptiles. Reptiles crawl on their bellies or creep on short legs. All reptiles breathe air and have backbones or spinal cords. Most of them reproduce by laying eggs, but some bear live youngs. Turtles are the oldest of the living reptiles.

(iii) Amphibians:

Amphibians are cold-blooded vertebrate animals which have descended from fishes. Their youngs develop in water and breathe with the aid of gills, but as they mature, they develop lungs and live on land. When they are ready to reproduce, they must return to water. Common amphibians include frogs, toads, newts and salamander.

(iv) Birds:

Birds are warm-blooded vertebrate animals whose body is covered with feathers. Birds descended from reptiles and lay shelled eggs. All birds have wings, but all birds don't fly. They are the fastest animals on Earth. There are about 8,600 kinds of birds. Birds have adapted to feed on all manners of food.

(v) Mammals:

Mammals are warm-blooded, air-breathing vertebrate animals which suckle their young ones. Young mammals are nourished on milk secreted by their mother's mammary glands. Most mammals bear live young, but some lay eggs. Common mammals include elephants, dogs, cats, monkeys and tigers.

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ORIGIN OF LIFE

Some of the important statements of scientists are reproduced below about the origin of life:

1.	"The trees and plants and animals, The oceans, air and mountains, The moon, the stars and galaxies, They share-both birth and origin"
2.	"The origin of life appears at the moment to be almost a miracle, so many are the conditions which would have had to have been satisfied to get it going".
3.	"Once thought to be a simple bag of chemicals, the cell is now understood to be an elaborate system of molecular machinery that surpasses a modern city in complexity".
4.	"In Einstein's conception of the Universe, a person is not an individual experiencing successive events but a four-dimensional".
5.	"Space-Time-Worm" to which the concept of the passing of time cannot be applied".
6.	"It is clear that there is no viable theory of the chemical origin of life".
7.	"There are no valid grounds for insisting that evolution is the only explanation for the variety of living form".
8.	"To suppose that the eye with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light could have been formed by natural selection, seems, I freely confess, absurd in the highest degree" — **Charles Darwin.**
9.	"Updating Darwin, scientists are showing that evolution sometimes leaps rather than creep and that life itself is stranger, more adaptive and more precarious than we ever dreamed".

Introduction:

Life is a set of dynamic chemical processes; when they stop, so does life, and the chemicals that once made up a body reduce themselves to a sludge. Living creatures are clearly complex web of chemical pathways-chains of chemical reactions in which a product of one becomes the starting point for another. Living things display seven characteristics; excretion, growth, irritability, locomotion, nutrition, reproduction and respiration. A very general definition of life is what living creatures do.

Origin:

Bacteria were the first living organisms and hence the oldest, they were born about three and a half billion years ago. Plants, animals and other multi cellular bodies were the next to come in the life cycle. But how bacteria came into existence in the first place, is still a mystery to biologists. However, according to the chemical evolution theory it is believed that simple molecules like methane, ammonia and hydrogen cyanide were first converted into amino acids and then to the proteins, and finally thousands of years, after, a cell was formed from the primeval soup. All living organisms must invariably contain carbon and life is organic in nature.

[redacted]

Sugars, fatty acids, the building blocks of DNA and more things are needed to build a bacterium. A bacterium, though simple by comparison with amoeba or a human body cell, is still a pretty complicated thing. Every present living thing seems to have descended from bacteria but they may still not be the first link just the oldest surviving one. The precursors of bacteria could have been simple self-replicating proteins. In a short conclusion, life is the most unique event of the Universe.

Extraterrestrial Intelligence:

Extraterrestrial intelligence means search for life on other planets. Most of the world scientists are of the opinion that life definitely exists on other planets but it will take a long time to prove it.

We are made up of cells, which are made of molecules, which in turn are made of atoms, themselves made of elementary particles. Nuclei are manufactured in the stars, molecules in interstellar space. If we trace back along our genealogical line, well before the apes, and the first living things-cells we must go back to the molecules, the atoms, the nucleons, back to the beginning of the universe 15 billion years ago.

No matter how far back into the Universe we look, we find the same elements: atoms, molecules, stars, galaxies. It can be shown that the laws of physics have remained unchanged through 15 billion light years. It is this homogeneity in the way that Universe behaves that allows us to think that life is not an improbable phenomenon, but a normal property of matter at the highest levels of its organization. So we can suppose that life appears when conditions permit and where Earth-like features exist, there is also the possibility that Earth-like life could arise too.

THE BASIS OF LIFE
CELLS

Introduction:

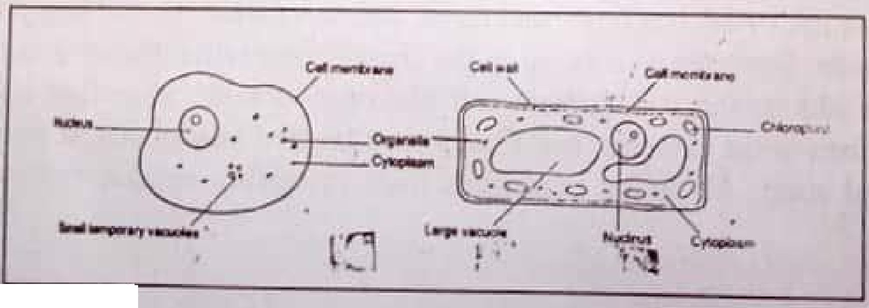
Cell is a structural and functional unit of all living organisms. It is a fundamental living unit. Cells are so small that they can only be seen under a microscope.

"Once thought to be a simple bag of chemicals, the cell is now understood to be an elaborate system of molecular machinery that surpasses a modern city in complexity".

The fact that both plants and animals are made up of cells is the basis of the **Cell Theory.** Each cell consists of two parts known as nucleus and cytoplasm. Cytoplasm is the large part of a cell which is a jellylike material and it contains water, food and dissolved gases. The cell contents are held together by a thin skin called a cell membrane. Embedded in the middle of the cytoplasm is a darker structure which has a rough surface. This is called the nucleus. This nucleus controls the anabolic (Constructive) activities and the cytoplasm controls the catabolic (destructive) activities.

Different Parts of Cell:

Essential parts of a cell are described below:



1. **Ribosomes:** The ribosomes manufacture protein molecules by following blueprints encoded in messenger RNA. The ribosomes have complex structure.
2. **Endoplasmic Reticulum:** The endoplasmic reticulum consists of a complex of membranes that form internal compartments used in the synthesis and transport of various compounds produced by the cell.
3. **Nucleus**: The nucleus contains the hereditary material, DNA, which carries instructions for the operation and perpetuation of the cellular machinery. Complex molecular processes are involved in replicating the DNA.
4. **Nucleolus**: The nucleolus is a factory for the partial manufacture of ribosomes.
5. **Microtubules:** The microtubules form a complex lattice work that gives form to the cell and enables it to systematically move and change shape.
6. **Lyosomes:** Lyosomes contain enzymes that break down unwanted material within the cell.
7. **Chloroplasts:** The chloroplasts, found in plant cells, are complex chemical factories that carry out photosynthesis.
8. **Cellular Membrane:** The cellular membrane is equipped with many complex protein and lipid molecules that regulate the passage of molecules into and out of the cell and act as sensors informing the cell of external conditions.
9. **Mitochondria:** The mitochondria are chemical factories that generate energy for the cell through the controlled breakdown of food molecules.

ANIMALS Vs PLANTS

No.	Animals	Plants
1.	**Points of Similarities** Smallest building blocks of animals are also cells.	Smallest building blacks of plants are also cells.
2.	Animals range from Unicellular to more complicated organisms consisting of multi-cellular bodies.	Plants also range from unicellular to more complicated organisms consisting of multi-cellular bodies.
3.	Animals grow in number by reproduction.	They also grow in number by Reproduction.
4.	Animals reproduce both sexually and asexually.	Plants also reproduce both sexually and asexually.
1.	**Points of differences** Animals are heterotrophic	Plants are autotrophic.
2.	Animals take oxygen and release carbon dioxide gas.	Plants take carbon dioxide and release oxygen gas.
3.	Animals are free to move from one place to the other.	They show restricted motion.
4.	Animal cells have no cell walls but they have cell membranes.	Plant cells have cell walls made up of cellulose to protect and surround the cell and cell membrane

5.	There are small vacuoles in animal cells.	There is a large Vacuole in plant cell.
6.	There is no chloroplast in animal cells.	There is chloroplast in plant cell.
7.	Animal life is dynamic.	Plant life is static.
8.	Animals need oxygen gas for their survival.	Plants need carbon dioxide gas for their survival.
9.	Animals do not carry a green pigment called chlorophyll.	Chlorophyll is an important part of all plants necessary for photosynthesis.
10.	Centrosomes containing centriole are present in animal cells.	No such substance is present in plant cells.
11.	Animals respond quickly to external stimuli.	Plants respond slowly to stimuli.
12.	In animals, Meiosis results in only one functional egg in female and 4 functional sperms in male.	In plants, instead of egg or sperms, micro gametes and mega gametes are formed.
13.	Plastids are usually absent in animal cell.	Plastids are usually present in plant cell.
14.	Metabolism forms toxic wastes which are removed by excretion.	Metabolic wastes are seldom toxic and not excreted.
15.	Cellulose is altogether absent in animal cell.	The skeleton of the body is made up of cellulose.
16.	Reserve food material is usually stored as Glycogen.	Reserve food material is stored as Starch grains.

GENETICALLY MODIFIED PLANTS

Genetically modified plants are created by the process of genetic engineering that allows scientists to incorporate genetic material between organisms with the aim of changing their characteristics. All organisms are composed of cells that contain DNA (deoxyribonucleic acid) molecules. Molecules of DNA form units of genetic information known as genes. Each organism has a genetic blueprint made up of DNA that determines the regulatory functions of its cells and thus the characteristics that make it unique.

Some applications of plant biotechnology include:

(1)	Developing plants that are resistant to diseases, pests, and stress.
(2)	Keeping fruits and vegetables fresh for longer periods of time which is extremely important in tropical countries:
(3)	Producing plants that possess healthy fats and oils. Producing plants that have increased nutritive value.
(4)	Producing soybeans with a higher expression of the anti cancer proteins naturally found in soybeans.
(5)	Developing a whole range of higher value added feed.
(6)	Other applications such as lignin modification in trees that will make possible much higher fiber extraction rates in the paper and pulp industry.

(7)	Producing new substances in plants, including biodegradable plastics and small proteins for peptides such as prophylactic and therapeutic vaccines.

MICROSCOPE

Introduction:

The microscope is an instrument for producing enlarged images of objects that are too small to be seen by the eye unaided. Such images may be viewed directly or with a viewing screen or photographic apparatus. Objects for microscopy may be either transparent or opaque. Microscope may be simple or compound.

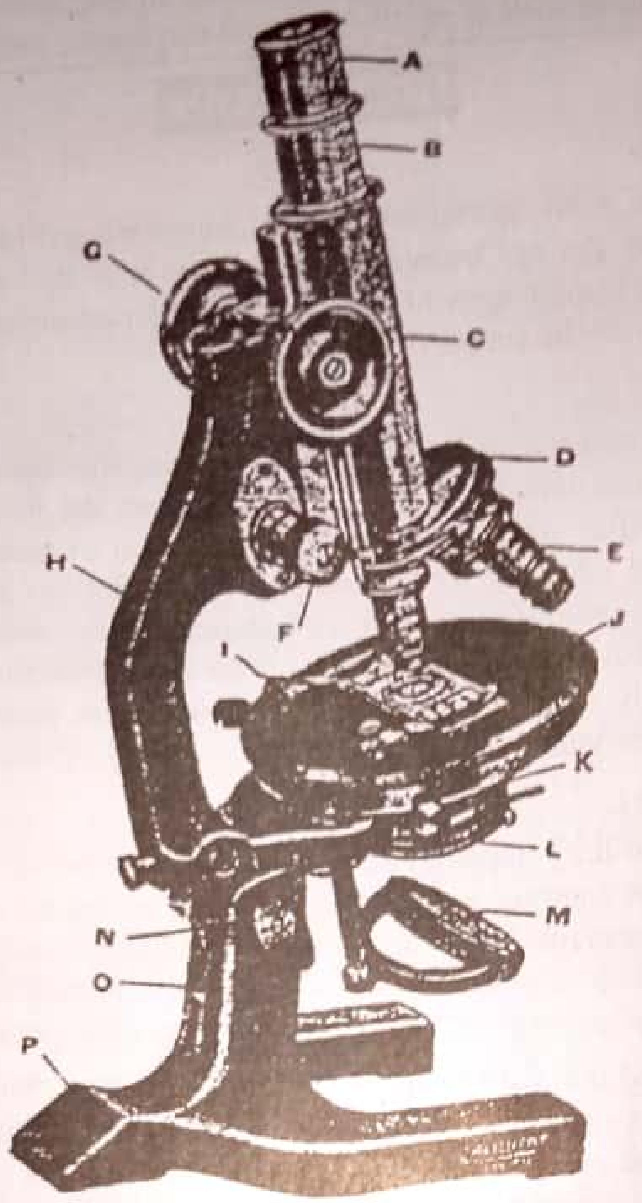
Simple Microscope:

A simple microscope, a single positive lens or lens combination, is often known as a magnifier. The simple one lens microscope may date from the middle of the 15th century, when low power magnifies were used for the examination of insects. Maximum apparent magnification is reached when the virtual image of the object lies at the nearest distance of distinct vision. Simple magnifiers suffer considerably from aberrations that affect the peripheral parts of the field of view; curvature of the field, distortion, and lateral chromatic aberration are principally involved. The simplest form of low-power magnifier is a single biconvex or plano-convex lens.

Compound Microscope:

The basic idea of the compound microscope is to use two or more lenses, arranged in such a way as to form an enlarged image of an object. A compound optical microscope is an instrument that produce a magnified image of a small object; as small as bacteria. Compound microscope has an objective lens (the lens closet to the object being viewed) and an eye-piece so mounted that they may conveniently be moved relative to the specimen to focus the image.

A typical compound microscope consists of a mirror that reflects light from an external source through a condensed lens system that concentrates and uniformly illuminates an object on stage. An objective fens system produces a real image of the object that is then seen by the eye to lie in a plane. The magnification obtained is equal to the product of the magnifications produced by the objective and eyepiece lenses. The value of a microscope lies in its ability not only to magnify objects but also to make their fine details visible. These two features depend for the most part on the quality of the lens that forms the primary image. Microscope objective lenses may be classified according to either their focal length or their type and degree of corrections.



Compound Microscope

A, Eyepiece; B, Draw tube; C, Body tube; D, Nosepiece (revolving); E, Objective F, Fine adjustment; G, Coarse adjustment; H, Arm; I, Clip; J, Stage; K. Condenser; L, Iris-diaphragm; M, Mirror; N, Inclination joint; O, Pillar; and P, Foot (horseshoe-shaped); of these A, E, K, and M constitute the optical parts and the rest constitute the mechanical parts.

Specialized Types of Microscope:

Many modern versions of the microscope have now been developed for specific purposes. Some of these can be named as under:

(i)	Stereoscopic binocular microscope
(ii)	Ultramicroscope
(iii)	Metallurgical microscope

(iv)	Phase-contrast microscope
(v)	Ultraviolet and fluorescence microscope
(vi)	Infrared microscope
(vii)	Polarizing microscope

The Electron Microscope:

It is the most modern and sophisticated version of the microscope. It came into commercial use in 1935. There are many differences between optical and electron microscopes. Instead of glass ienses, electromagnetic lenses are used. Unlike this optical microscope, in which the lenses are of fixed focus and the distance between specimen and objective is varied, the electron microscope has variable-focus lenses, and the distance between specimen and objective lens and separation of the lenses remain constant.

The optical microscope is usually operated so that the image is a virtual one, and in the electron 'microscope the final image is invariably real and is visualized on a fluorescent screen or recorded for study on a photographic plate'.

In the optical microscope, the image is formed by absorption of light in the specimen. In the electron microscope the image results from the scattering of electrons by atoms in the specimen.

For practical reasons of image stability and brightness, the microscope is often operated to give a final magnification of 1000-50,000 magnitudes on the screen. It is possible to see small viruses and large molecules with the help of electron microscope.

DISEASES

Introduction:

When everything is functioning properly in the animal body, all systems of the body are synchronized, working in a state of harmony that is characterised as healthy. If the functions of cells or organs are disrupted enough to cause signs or symptoms of abnormal conditions, the organism is said to be diseased. All diseases can be considered to some degree both genetic and environmental in their pathogenic characteristics. Diseases can be caused by pathogens, namely bacteria, spirochete viruses, fungi, amoebae, parasites and worms. Diseases can be infectious or non-infectious.

Infectious Diseases:

These are those diseases which are caused by the attack of an organism outside the body conveyed into human body in different ways. These can be transmitted by air, water or skin.

Cholera:

It is an acute diarrhoeal disease caused by vibrio cholera or related vibrios. A pandemic of cholera is in progress. The infection is acquired by the ingestion of food or drink contaminated by faces from cases or carriers containing a large number of vibrios. The vibrios grow in small intestine and produce a powerful exotoxin. As a result, massive diarrhoea occurs which is fatal if untreated. The incubation period is 1-5 days. Cholera vaccine gives only limited protection and is of no value in controlling outbreaks.

TRANSMISSION THROUGH	TYPICAL INFECTIOUS DISEASES	
Air	Whooping Cough, TB	
Water	Cholera, Jaundice	
Skin	Mosquito Bite	Malaria, Yellow Fever Filaria (Elephentiasis)
	Animal Bite	Rabies, Plague
	Miscellaneous	Influenza, Measels
Blood	Hepatitis, AIDS	

Malaria:

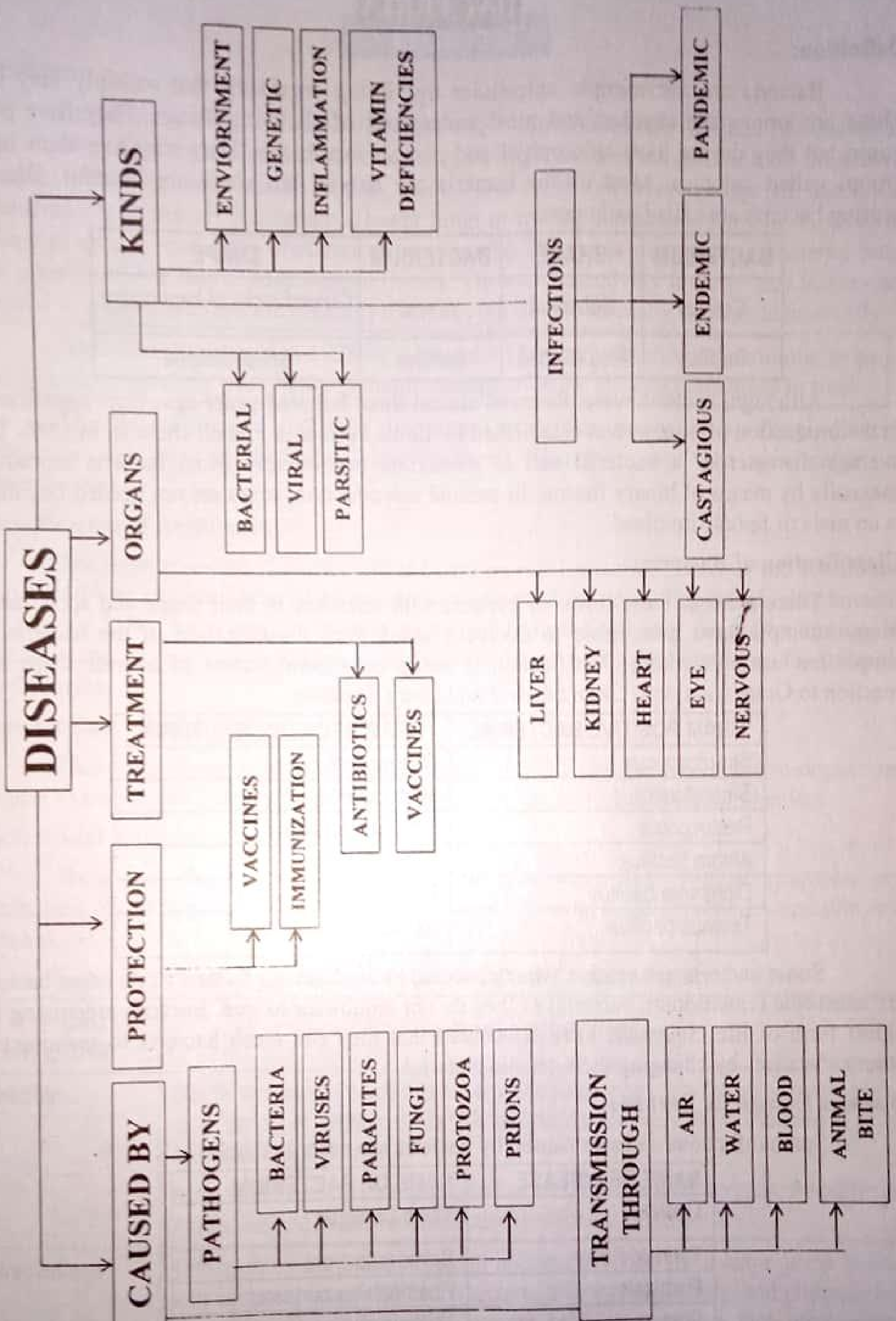
Malaria is transmitted from human to human by the bite of infected female anopheles mosquitoes. Symptoms are chills, fever and sweating. Four species of the genus Plasmodium are responsible for human malaria. The most common parasites are; Plasmodium vivax, flaciparum, malaria and ovale. The mosquito becomes infected by taking blood containing the sexual forms of the parasite. Red blood cells are ruptured in this process. The incubation period varies considerably (8-20 days).

Typhoid Fever:

Typhoid fever is caused by the gram negative rod salmonella typhi, (bacteria) which enters the patients via gastrointestinal tract. Infection is transmitted by consumption of contaminated food or drink. The incubation period is 5-14 days.

Pertussis (Whooping Cough)

It is an acute infection by the respiratory tract caused by Bordetella pertussis. It is transmitted by respiratory droplets from infected individuals. The incubation period is 7-17 days.


DISEASES
CAUSED BY
PATHOGENS
BACTERIA
VIRUSES
PARACITES
FUNGI
PROTOZOA
PRIONS
TRANSMISSION THROUGH
AIR
WATER
BLOOD
ANIMAL BITE
PROTECTION
VACCINES
IMMUNIZATION
TREATMENT
ANTIBIOTICS
VACCINES
ORGANS
LIVER
KIDNEY
HEART
EYE
NERVOUS
KINDS
ENVIORNMENT
GENETIC
INFLAMMATION
VITAMIN DEFICIENCIES
BACTERIAL
VIRAL
PARSITIC
INFECTIONS
CASTAGIOUS
ENDEMIC
PANDEMIC

BACTERIA

Definition:

Bacteria are microscopic unicellular free living organisms that multiply very fast. These are among the smallest and most widespread of all living things. They have plant origin but they do not have chlorophyll and nuclear membrane. They may live alone or in groups called colonies. Most of the bacteria are helpful but some are harmful. Disease causing bacteria are called pathogens.

BACTERIUM	SHAPE	BACTERIUM	SHAPE
Coccus	Spherical	Vibrios	Curved rocks of bent cigars
Bacillus	Rod shaped	Spirillus	Spiral Shaped

Although, bacteria were observed almost three hundred years ago, their significance in the production of disease was established by Louis Pasteur, a French chemist, in 1856. The average diameter of a bacterial cell is about one millimicron. Most bacteria reproduce asexually by means of binary fission. In asexual reproduction, sexes are not needed i.e., there is no male or female involved.

Classification of Bacteria:

There are four basic forms of bacteria with reference to their shape and appearance. Many attempts have been made to evolve a satisfactory classification of the bacteria. A simple but useful working classification is based on a combination of overall shape and reaction to Gram stain; into Gram positive and Gram negative.

GRAM POSITIVE BACTERIAL	GRAM NEGATIVE BACTERIA
Streptococcus	Gonococcus
Staphylococcus	Meningococcus
Peptococcus	Influenza bacillus
Anthra bacillus	Plague bacillus
Diphtheria bacillus	Proteus
Tetanus bacillus	Salmonella providenica

Some bacteria are aerobic (streptococcus) and require air to live while other bacteria are anaerobic (clostridium, bacteria) as they do not require air to live. Bacteria are among the oldest form of life. Scientists have discovered that they can teach bacteria to manufacture other substances by changing their genetic material.

Diseases Caused by Bacteria:

Some infectious diseases caused by bacteria are described below:

NAME OF DISEASE	NAME OF BACTERIUM
Cholera	Vibrio Cholerae
Typhoid Fever	Salmonella typhi
Pertussis	Haemophilus pertussis
Plague	Yersinia pestis
Shigellosis	Shigella dysenteriae

ANTIBIOTICS

Definition:

The term antibiotic means "against life". Antibiotics are defined as chemicals produced by microorganisms that have capacity in small concentrations to inhibit the growth of other microorganisms or to destroy them. The most important groups of antibiotic-producing organisms are the bacteria, lower fungi or molds, and anti-nomycytos. Antibiotics belong to very diverse class of chemical compounds. The drugs work against bacteria, fungi and other microbes that damage human tissues. They are selectively toxic — that is, they are harmful to pathogenic (disease causing) microbes but do not normally damage human cells.

Penicillin, discovered in 1928 by Alexander Fleming, was the first antibiotic to be widely and successfully used in the systemic therapy of acute bacterial infections in man.

The Penicillins are the only important antibiotics produced by fungi. Several antibiotics are now synthetically also produced, therefore they are also called as Antimicrobials.

Classification of Antibiotics:

The most common classification is based on mechanism of action of the antibiotics. Two broad kinds of antibacterial effect can be distinguished, depending on whether bacteria are actively killed by a drug, or merely prevented from multiplying. An antibiotic may be bactereostatic at low concentrations, and bactericidal at high concentrations, for example Erythromycin.

Bactereostatic Antibiotics:

These are those antibiotics which merely inhibit the growth of micro-organisms. Typical examples are Tetracyclene, Erythromycine, Linomycin and chloram-phenicol.

Bactericidal Antibiotics:

These are those antibiotics which kill microorganisms. Typical examples are Penicillins, Streptomycin, Kanamycin, Cefoxitin, Cefamadole, Cefotaxime, Ampicillin and Cefobid.

Some Typical Antibiotics and their Characteristics

TYPICAL ANTIBIOTIC	CHARACTERISTICS
Penicillin	Strictly speaking, Penicillin is not any one substance but is the name given, to salts of a series of organic acids. Of all the natural Penicillins, Penicillin-G is still recognised as the best. It is useful for killing both gram positive and gram negative bacteria. Ampicillin and Amoxicillin and Mezloxillin are modern versions of penicillin-G.
Tetracyclines	Tetracyclines are broad spectrum antibiotics. These are a large group of drugs with common, basic chemical structure, antimicrobial activity, and pharmacologic properties. These are active against both gram-positive and gram-negative bacteria.
Streptomycin	It is an antibiotic belonging to a family of Amino glycosides of which the members

	are neomycin, kenamycin, gentamycin, amikacin, tobramycin and sisomicin. It is more effective against gram-negative bacteria and is useful in treatment of T.B. meningitis and pneumonia.
Cephalosporins	This belongs to β-Lactam drugs related to penicillins. Their mode of action is also similar. These have successive generation of antibiotics. Typical examples are: cephalexin, cefobid, cefoxicitin, cefotaxime and cefamandole.

Limitations and Side Effects:

Most of the antibiotics are not effective against the diseases caused by viruses. Almost all the antibiotics are slightly toxic and hence should be taken with a lot of care. These drugs are commonly associated with outward reactions like hypersensitivity, direct toxicity like nausea, vomiting and diarrhoea. Some are given orally and other intramuscularly.

VACCINES

Definition:

It may be defined as a suspension of killed or attenuated live organisms; bacteria or virus, in normal saline designed to protect the body against a specific-disease by stimulating the formation of antibodies. These organisms provide immunity but do not cause the disease. An antibody is a blood serum protein of the globulin fraction which is formed in response to introduction of an antigen; which is an ineffective organism. It is capable of inducing formation of an antibody in an organism into which it is introduced. The entire science of immunology is due to antigen-antibody reactions, the most outstanding feature of which is their specificity. These antibodies produced in the bloodstream can react only with the homologous antigen or with those of a similar molecular structure. As a result, the animal can destroy a particular virus or bacterium and becomes immune.

Immunization:

It is the process of protecting the body against disease by means of vaccines or serums. Vaccines provide immunity by causing the body to manufacture antibodies, which fight against disease. Serums furnish immunity by adding antibodies directly to the blood. Immunization may be active or passive.

Characteristics of Vaccines:

(1)	Vaccines may be oral or intramuscular; most are injected into the body.
(2)	Vaccines are safe and reliable but they are not perfect.
(3)	Most vaccines begin to person with immunity about two weeks after being administered.
(4)	A single dose of some vaccine provides a lifelong protection against infection.
(5)	Some vaccines require several doses to produce immunity and then must be reinforced at regular intervals with booster doses.

SOME COMMON VIRAL DISEASES ARE

(1) **Measles:**

An acute infectious disease of childhood cause by a virus spread by droplets. Symptoms are high fever, rash on face and behind the ears, conjunctivitis, with redness, swelling, photophobia and discharge. Attenuated live virus vaccine can greatly reduce the incidence of measles.

(2) **Mumps:**

It is viral (paramyxovirus) disease spread by respiratory droplets that usually produces inflammation of the salivary glands. Most patients are children. The incubation period is 14-21 days (average 18 days). Symptoms are high fever and painful swollen salivaiy glands. Mumps live virus vaccines is safe and highly effective.

(3) **Rabies:**

It is a viral (rhodovirus) encephalitis transmitted by infected saliva that gains entry into the body by a bite or open wound. Dogs, bats and foxes are extensively infected. The virus travels in the nerves to the brain, multiplies there and then, migrates along the different nerves to the salivary glands. It is an inflammatory disease of the central nervous system. Hydrophobia is a typical symptom. The human diploid cell rabies vaccine is used for its prevention.

Other Viral Diseases:

Poliomyelitis, Rubella, Yellow Fever, Influenza, Hepatitis and Smallpox.

Avian Influenza:

Avian influenza, sometimes **avian flu**, and commonly **bird flu**, refers to "influenza caused by viruses adapted to birds."

"Bird flu" is a phrase refers to an illness caused by any of many different strains of influenza viruses that have adapted to a specific host. All known viruses that cause influenza in birds belong to the species *influenza A virus*. All subtypes (but not all strains of all subtypes) of influenza A virus are adapted to birds, which is why for many purposes avian flu virus is the influenza A virus (note that the "A" does not stand for "avian").

The highly pathogenic influenza A virus subtype H5N1 virus is an emerging avian influenza virus that has been causing global concern as a potential pandemic threat. It is often referred to simply as "bird flu" or "avian influenza" even though it is only one subtype of avian influenza causing virus.

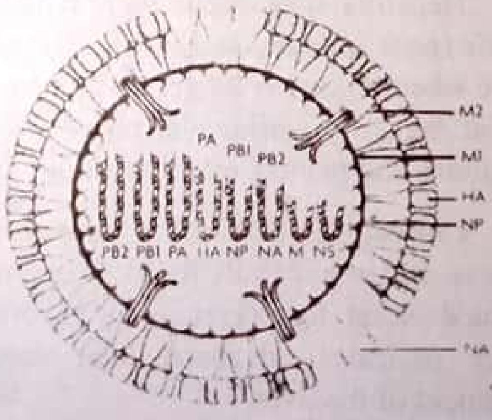


Fig: Bird Flu Virus

Swine Flu:

Swine influenza (also called **pig influenza, swine flu, hog flu** and **pig flu**) is an infection by any one of several types of swine influenza virus. Swine influenza virus is any strain of the influenza family of viruses that is endemic in pigs.

As of 2009, the known SIV strains include influenza C and the subtypes of influenza A known as H1N1, H1N2, H3N1, H3N2, and H2N3.

Swine influenza virus is common throughout pig populations worldwide. Transmission of the virus from pigs to humans is not common and does not always lead to human influenza, often resulting only in the production of antibodies in the blood. If transmission does cause human influenza, it is called zoonotic swine flu. People with regular exposure to pigs are at increased risk of swine flu infection. The meat of an infected animal poses no risk of infection when properly cooked. However certain mammals such as hedgehogs are immune from swine flu.

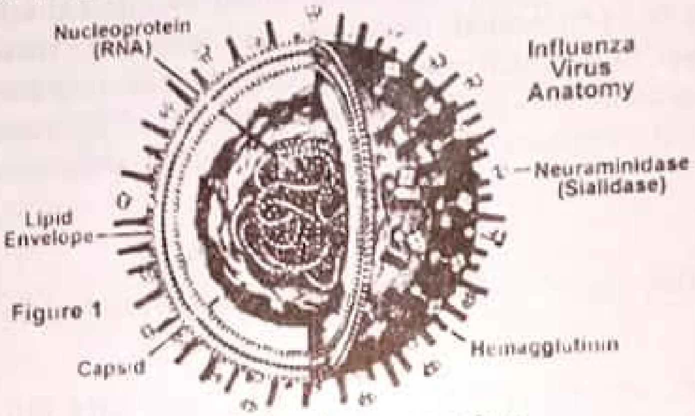


Fig. Swine influenza virus

Hepatitis:

Hepatitis is an inflammation of the liver characterized by the presence of inflammatory cells in the tissue of the organ. The condition can be self-limiting or can progress to fibrosis and cirrhosis.

Hepatitis may occur with limited or no symptoms, but often leads to jaundice, anorexia (poor appetite) and malaise. Hepatitis is **acute** when it lasts less than six months and chronic when it persists longer. A group of viruses known as the hepatitis viruses cause most cases of hepatitis worldwide, but it can also be due to toxins (notably alcohol, certain medications and plants), other infections and autoimmune diseases.

Chronic hepatitis often leads non-specific symptoms such as malaise, tiredness and weakness, and often leads to no symptoms at all. It is commonly identified on blood tests performed either for screening or to evaluate non-specific symptoms. The occurrence of jaundice indicates advanced liver damage. On physical examination there may be enlargement of the liver.

Extensive damage and scarring of liver (i.e. cirrhosis) leads to weight loss, easy bruising and bleeding tendencies, peripheral edema (swelling of the legs) and accumulation of fluid in the abdominal cavity. Eventually, cirrhosis may lead to various complications: esophageal varices (enlarged veins in the wall of the esophagus that can cause life-threatening bleeding) hepatic encephalopathy (confusion and coma) and hepatorenal syndrome (kidney dysfunction).

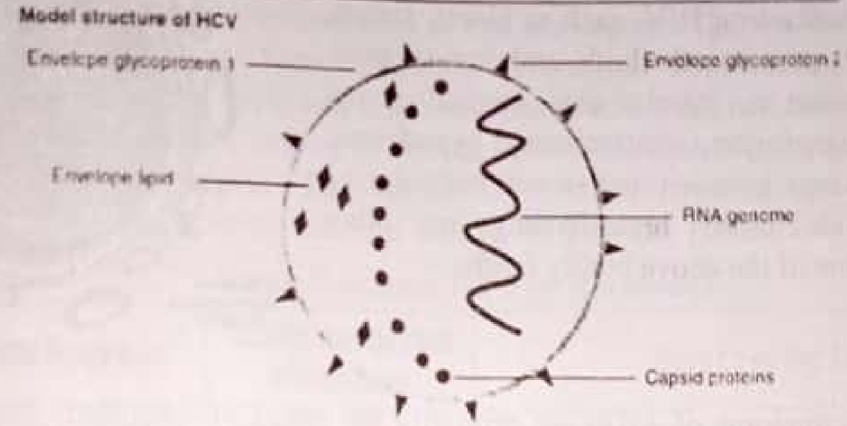


Fig. Hepatitis C Virus

DENGUE FEVER:

Dengue fever are acute febrile diseases transmitted by mosquitoes, which occur in the tropics, can be life-threatening, and are caused by four closely related virus serotypes of the genus *Flavivirus*, family Flaviviridae. It is also known as **breakbone fever**, since it can be extremely painful.

The disease manifests as fever of sudden onset associated with headache, muscle and joint pains (myalgias and arthralgias—severe pain that gives it the nickname break-bone fever or bonecrusher disease), distinctive retro-orbital pain, and rash. The classic dengue rash is a generalised maculopapular rash with islands of sparing.

Dengue fever is caused by Dengue virus (DENV), a mosquito-borne flavivirus.

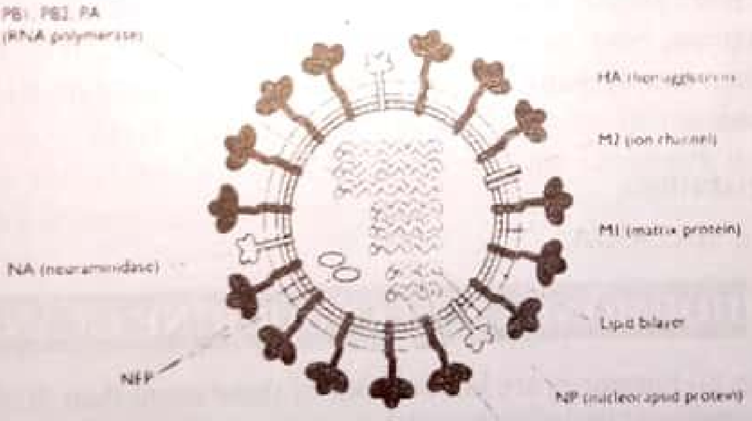


Fig. Dengue virus

AIDS

Acquired immune deficiency syndrome or **acquired immunodeficiency syndrome (AIDS)** is a disease of the human immune system caused by the human immunodeficiency virus (HIV). This condition progressively reduces the effectiveness of the immune system and leaves individuals susceptible to opportunistic infections and tumors.

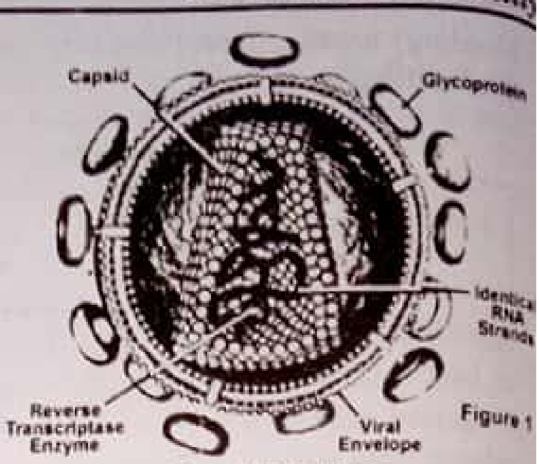


Fig. AIDS Virus

HIV is transmitted through direct contact of a mucous membrane or the bloodstream with a bodily fluid containing HIV, such as blood, semen, vaginal fluid, preseminal fluid, and breast milk. This transmission can involve anal, vaginal or oral sex, blood transfusion, contaminated hypodermic needles, exchange between mother and baby during pregnancy, childbirth, breastfeeding or other exposure to one of the above bodily fluids.

The symptoms of AIDS are primarily the result of conditions that do not normally develop in individuals with healthy immune systems. Most of these conditions are infections caused by bacteria, viruses, fungi and parasites that are normally controlled by the elements of the immune system that HIV damages.

Pneumocystis pneumonia is relatively rare in healthy, but common among HIV-infected individuals.

Tuberculosis (TB) is unique among infections associated with HIV because it is transmissible to immunocompetent people via the respiratory route.

Tuberculosis with HIV co-infection (TB/HIV) is a major world health problem according to the World Health Organization: in 2007, 456,000 deaths among incident TB cases were HIV-positive, a third of all TB deaths and nearly a quarter of the estimated 2 million HIV deaths in that year.

Symptoms are usually constitutional and are not localized to one particular site, often affecting bone marrow, bone, urinary and gastrointestinal tracts, liver, regional lymph nodes, and the central nervous system. Unexplained chronic diarrhea in HIV infection is due to many possible causes.

Vaccines in Preparation:

AIDS and MALARIA.

HORMONES AND ENDOCRINE GLANDS

More than 80 hormones are known. Out of these more than 50% are steroids whereas the remaining hormones are non-steroidal in nature. Hormones are chemical substances produced by the cells of one part of an organism and transported by the fluids of the organism to another site where they exert specific action.

Hormones are organic in nature, and are synthesised in the endocrine glands and then discharged directly in the circulatory system. They serve as chemical messengers or regulators. They cause the reactions to speed up or slow down. In this way they control growth, metabolism, reproduction and many other functions of the body and mind.

[redacted]

Sex Hormones:

Male sex hormones are called androgens. They are secreted by the Testes. These hormones are responsible for development of the sex organs. The female sex hormones are called Estrogens. They are produced mainly in the ovaries. They control the female sexual functions, such as menstrual cycle and the development of breasts and other secondary sexual characteristics. Sex hormones belong to steroid family of organic compounds and these can also be synthetically produced. The activity of the sex hormones is controlled by the hormones that are produced in the anterior lobe of the pituitary gland.

Some Common Human Hormones

NAME OF THE HORMONE	GLAND SECRETING HORMONES	EFFECT IN THE BODY
Human Growth Hormones	Pituitary	Controls the general body growth.
Thyroxin	Thyroid	Increases rate of cellular metabolism.
Insulin	Pancreas.	Metabolises sugars & fats
Cortisol	Adrenal	Stimulates conversion of proteins to carbohydrates.
Testosterone	Testes	Stimulates and maintains male sex characteristics
Progesterone Estradiole	Ovaries	Regulates menstrual cycle, maintains pregnancy and stimulates sex characteristics

THE ENDOCRINE GLANDS

These are those glands which pour their newly made secretions directly into the blood stream. These are also known as ductless glands. They are following in kinds:

Pituitary Gland:

It is about the size of a pea, and is attached to the brain by a stalk, just below the point where the optic nerves join the brain. It has two parts called the anterior and posterior lobes. It is often called the **Master Gland** because the hormones it releases influence the workings of many of the other endocrine glands.

Thyroid Gland:

The gland is made up of two parts and is shaped like a bow. Its secretion effects physical and mental development in children and adults.

Pancreas:

The gland is shaped like a tongue. It lies just below the stomach. It produces Insulin and Glucagon which helps to control the level of sugar in the blood.

Adrenal:

Suprarenal gland placed on kidney. It secretes two hormones called Epinephrine and Norepinephrine.

Testes:

In males there is a pair of testes which are contained in a sac at the base of the abdomen and outside of the body.

Ovaries:

There are a pair of small organs in the lower abdomen of a female which are called ovaries:

CHROMOSOMES

Introduction:

The nucleus of each cell contains a number of very small thread like structure called chromosomes. The term chromosome was introduced into the scientific vocabulary by Waldeyer in 1888. Each chromosome consists of hundreds of molecules of nucleoproteins is called genes. In the nucleus of the cell, the chromosomes are present as two identical sets which pair off, each pair consisting of two identical chromosomes. Chromosomes are hereditary material.

Number and Types:

The number of chromosomes in each cell is fixed for a particular species. In human beings, it is 46. This is called as **diploid Number (2n).** However, in spermatozoa and ova, the number of chromosomes is only half the diploid number, i.e. 23. This is called as **Haploid number (n).** Each of the 46 chromosomes is a member of a homologous pair, one member of each pair being received from the mother and one from the father. Twenty-two of the pairs are identical in both sexes and are called somatic chromosomes. In the male, there is one X chromosome and a clearly different chromosome, the Y chromosome. However, in the female, both the sex chromosomes are 'X' chromosomes. Chromosomes may assume various shapes, twisted, spiral, curved or rod-shaped.

Chemical Composition:

The chemical constituents of chromosome are:

(i) Deoxyribo Nucleic Acid (DNA)
(ii) Ribo Nucleic Acid (RNA)
(iii) Histones
(iv) Acidic proteins

Importance of Chromosomal Studies:

Chromosomal studies are useful in:

(i)	Diagnosis of various chromosomal abnormalities like Turner's syndrome, and Down's syndrome.
(ii)	Clinically, in investigation of patients with abnormalities of sexual developments or infertility.
(iii)	In determination of sex of an unborn child.
(iv)	In large-scale population surveys, e.g., to detect the effects of occupational hazards on chromosomes in relation to various environmental factors like cold, heat, chemicals and dust.
(v)	In new fields involving separation of 'X' and 'Y' bearing sperms.

The human chromosomes carry all the information we require to live, grow and reproduce. But hidden somewhere may be a gene that ensures a preprogrammed death.

GENES

Introduction:

Genes are natural units of hereditary material stored in chromosomes and these are the physical basis for the transmission of the characteristics of living organisms from one generation to the other. The term 'gene' was introduced by Johannsen in 1909. Genes can be imagined as being strung together like beads to form the threadlike chromosome. Genes can also predict diseases. A genetic linkage map was published in 1987 of the entire human genome covering the 23 pairs associated with genetically based human illnesses.

GENERAL PROPERTIES AND FUNCTIONS

More important properties and functions of the genes are described below:

(1)	Capability to determine traits, e.g., skin colour, intelligence, temperament, blood group etc. They maintain the specificity of an individual.
(2)	Ability to undergo identical reproduction (Replication). They play vital role in the transmission of characteristics from parents to offspring.
(3)	Ability to undergo mutation. This term is used to denote a physio-chemical change in genes which alter the effect on the character influenced by it.
(4)	Genes are very important for synthesis of various proteins and enzymes of the cell.

Number:

Every gene lies in a particular position on the chromosome to which it belongs. This specific position is referred to as the Locus of Genes. Nucleus of chromosome contains about 20,000 genes, half of which being contributed by each parent.

Chemical Basis:

DNA is the chemical basis of genes and is indeed the hereditary material. Genes act through controlling the protein constitution of cells.

CLASSIFICATION OF GENES

It can be classified into the following categories.

CLASSIFICATION	DEFINITION
Structural Gene	It controls the structure of a polypeptide comprising the protein.
Super Gene	It is a group of genes which encode a number of functionally related proteins.
Operator Gene	It exercises control over a set of contiguous structural genes and collectively constitutes an operation.
Regulator Gene	It is responsible for controlling the particular activity of a specific operation.
Temporal Gene	It is concerned with regulation of protein synthesis in relation to time.
Architectural Gene	It guides the exact localization of enzymes and protein in various cellular organelles.
Pleiotropic Gene	It influences more than one phenotypic trait.
Sex linked Gene	These genes are linked with sex chromosomes.

GENETIC ENGINEERING

Genetic engineering, also called **genetic modification**, is the human manipulation of an organism's genetic material in a way that does not occur under natural conditions. It involves the use of recombinant DNA techniques, but does not include traditional animal and plant breeding. Any organism that is generated using these techniques is considered to be a genetically modified organism.

The first organisms genetically engineered were bacteria in 1973 and then mice in 1974. Insulin producing bacteria were commercialized in 1982 and genetically modified food has been sold since 1994.

APPLICATIONS

(i) Medicine

In medicine genetic engineering has been used to mass produce insulin, human growth hormones, follistim (for treating infertility), human albumin, monoclonal antibodies, vaccines and many other drugs.

Genetic engineering is used to create animal models of human diseases. Genetically modified mice are the most common genetically engineered animal model. They have been used to study and model cancer, obesity, heart disease, diabetes, arthritis, substance abuse, anxiety, aging and Parkinson disease.

(ii) Gene therapy:

Gene therapy is the genetic engineering of humans by replacing defective human genes with functional copies. This can occur in somatic tissue or germline tissue. If the gene is inserted into the germline tissue it can be passed down to that person's descendants.

Gene therapy has been used to treat patients suffering from immune deficiencies and trials have been carried out on other genetic disorders.

(iii) Research:

Genetic engineering is an important tool for natural scientists. Genes and other genetic information from a wide range of organisms are transformed into bacteria for storage and modification, creating genetically modified bacteria in the process. Bacteria are cheap, easy to grow, clonal, multiply quickly, relatively easy to transform and can be stored at -80°C almost indefinitely. Once a gene is isolated it can be stored inside the bacteria providing an unlimited supply for research.

(iv) Industrial

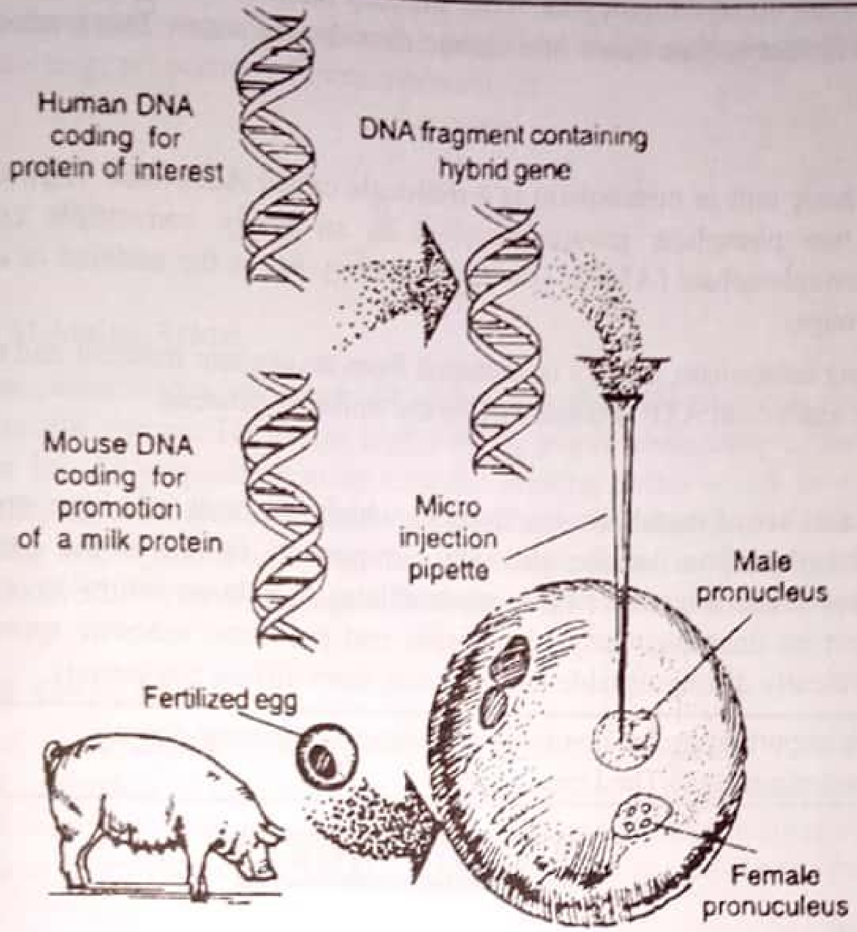
By engineering genes into bacterial plasmids it is possible to create a biological factory that can produce proteins and enzymes. Bacteria and yeast factories have been used to produce medicines such as insulin, human growth hormone, and vaccines, supplements and fuels.

(v) Agriculture:

One of the best-known and controversial applications of genetic engineering is the creation of genetically modified food.

There are three generations of genetically modified crops. First generation crops have been commercialized and most provide protection from insects and/or resistance to herbicides.

The second generation of genetically modified crops being developed aim to directly improve yield by improving salt, cold or drought tolerance and to increase the nutritional value of the crops. The third generation consists of pharmaceutical crops, crops that contain edible vaccines and other drugs.


Human DNA coding for protein of interest
DNA fragment containing hybrid gene
Mouse DNA coding for promotion of a milk protein
Micro injection pipette
Male pronucleus
Fertilized egg
Female pronuculeus

METABOLISM

Introduction:

Metabolism is a term that embraces all of the chemical changes that occur in the cells of living organisms, enabling them to grow, to maintain their identity and to reproduce. All living things need energy for survival which is provided by food. Each chemical change in metabolism is catalyzed by a specific protein called an Enzyme. The chemical processes of metabolism perform several key functions. They provide the energy necessary for work — not only the mechanical work that involves the use of muscles, but also the chemical work required to build complicated molecules like DNA, RNA and proteins. Metabolic reactions also convert food into forms that can be stored until needed. Metabolism is characterised by two basic sets of reactions.

Catabolism:

It is that set of metabolic reactions in which break down of bigger organic molecules (food) occurs into usable smaller chemical component. The principle nutrients of food are polysaccharides, lipids and proteins. The enzymatic breakdown of these substances provides living cells with chemical compounds necessary to provide energy and synthesize their own compounds. Catabolism of these nutrients occurs through a long chain of biochemical reactions, which can be divided into three phases. In the first phase, large molecules are broken down into fatty acids and glycerine, polysaccharides into glucose and proteins into amino acids. In the second phase, these smaller units are further broken down into 3-carbon compound called Acetyl Coenzyme. This process releases energy. In the third phase, this compound is further broken down into carbon dioxide and water. This reaction provides most of the energy.

ATP:

The basic unit in metabolism is a molecule called Adenosine Triphosphate (ATP). It consists of two phosphate groups attached to an easily convertible compound called adenosine monophosphate (AMP). The key to energy use is the addition or deletion of these phosphate groups.

During catabolism, energy is captured from an organic material and transformed into ATP. During anabolism ATP is consumed in the building process.

Anabolism:

It is that set of metabolic reactions in which synthesis of bigger organic molecules (proteins) take place from smaller chemical components formed in the catabolic processes which are also called interconvertible intermediates. Catabolic routes have clearly defined beginnings but no unambiguously identifiable end products; anabolic routes, on the other hand, lead to clearly distinguishable end products from diffuse beginnings.

There are two important cycles involving the metabolic process namely *(i)* The Krebs cycle and *(ii)* The Urea cycle.

BIOMOLECULES

PROTEINS

Proteins are defined as compounds of high molecular weight made up of L-amino acids linked to one another by peptide linkages proteins contain 20 odd individual amino acids present in characteristic proportions and linked in specific sequence in each protein.

Proteins are linear polymers consisting of L-amino acids. The amino acids in proteins are united through an acid-amide type of bond called a peptide linkage. Hydrolysis of proteins involves hydrolysis of peptide linkages, since a protein molecule may contain hundreds of amino acid groups.

The unique catalytic and structural properties of proteins arise in part from the cloud of side chains anchored to the polymer peptide. The structures of proteins enable term to act as the catalysts (enzymes) which control the rates of all biological reactions. They can act as regulators (hormones) of physiological relationships.

General Properties of Proteins:

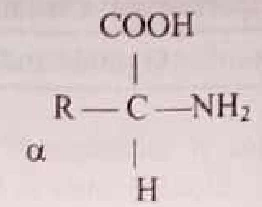
Pure proteins are generally tasteless, though the predominant taste of protein hydrolyses is bitter. Pure proteins or odourless. When heated, they turn brown and char and give off the odour, of burning feathers or hair. As the protein molecules are exceedingly complex in structure and are very large so they have high molecular weights ranging from 10,000 to 100,000.

AMINO ACIDS

Naturally occurring amino acids are amino acids containing amino group and carbonyl group on the carbon atom and are represented by the general formula.

FORMULA

All amino acid found in living systems, plant and animal proteins are L-x-amino acids. About two dozen amino acids have been established as occurring in proteins, and most pretenses contain a large proportion of these amino acids.



$$\begin{array}{c} \mathrm{COOH} \\ | \\ \mathrm{R}-\mathrm{C}-\mathrm{NH_2} \\ \alpha \quad | \\ \mathrm{H} \end{array}$$

Characteristics of Amino Acids:

In general, the amino acids are readily soluble in water. Most of the amino acids are optically active except glycine. They have high melting points while many of the amino acids undergo more or less decomposition at or near the melting points which as a result is not sharp. Amino acids are usually either sweet, tasteless or bitter. Amino acids have zulitterion structures showing acidic and basic properties. The sodium salt of glutamic acid, sodium glutamate, is valuable as a flavouring agent for certain sources and foods, since it enhances the flavor.

Classification of Amino Acids:

The 20 different amino acids differ in their side-chain R groups. As the identity and unique chemical properties of each amino acid and the ways in which each amino acid and affect the properties of a protein are determined by its R group. Classification of amino acids is done on the basis of the nature of the R group. Classification can be done in two ways. One way is:

(1) Aliphatic Amino Acids:

When the R group in the amino acid is aliphatic, it is called as aliphatic amino acids.

Examples are: Glycine, Valine, Alanine, Leucene etc.

(2) Aromatic Amino Acids:

When the R group in the amino acid is Aromatic, it is called as Aromatic amino acid.

Examples are: Phenyl Alanine and Tryosine

(3) Heterocyclic Amino Acids:

When the R group in the amino acid is heterocyclic, it is called as Heterocyclic Amino acid.

Second Classification is based on the type of polarity of the R group like.

- **(i) Uncharged but polar**
- **(ii) Small uncharged and non-polar**
- **(iii) Large non-polar**
- **(iv) Positively or Negatively charged.**

CLASSIFICATION OF AMINO ACIDS	
Nature of group	**Examples**
Natural Non-polar Amino Acids	Glycine, Alanine, Valine, Leucine, Isocauline, Phenylalanine, Tryptophan Methionine, Cystein and Protine
Natural Polar Amino Acids	Serine, Threonine, Tryosine, Asparagine and Glutamine.
Acidic Amino Acids	Aspartate and Glucamate
Basic Amino Acids	Lysine, Arginine and Histidine

Functions of Amino Acids:

Amino acids serve as:

(i) Building block of proteins

(ii) As precursors of Hormones, Purnies, pyrimidines, porphyrins and Vitamins.

Essential Amino Acids:

These are those amino acids which are not synthesized in the body and hence have to be provided in the diet. They are also called indensible amino acids. They are eight in number namely, Leucine, Isoleucine, Threonine, Tryptophan, phenylalamine, valine, Methionene and Lysine. Adquate amounts of essential amino acids are required to maintain the proper nitrogen balance.

Classification of Proteins

Proteins are classified on the basis of their composition.

1. **Simple proteins**

Simply proteins are made up of amino acids only and on hydrolysis yields amino acid mixture only.

Example

I	Fibrous proteins	These are animal proteins which are highly resistant to digestion by proteolytic enzymes. They are water insoluble.
	(a) Collagens	It contains high proportion of hydroxy proiine and hydroxylysine. It is a major protein of connective tissues. On boiling, with water it forms gelatin.
	(b) Elastins	It is present in tendons and arteries.
	(c) Keratins	It contains large amount of sulphur as cystine. It is present in hair, wool, nails etc.

2. **Globular proteins:**

(a) Albumins	Serum albumin and ovalbumin of egg white. It is water soluble. It is precipitated from solution by full saturation of ammonium sulphate. It is coagulated by heat.

(b)	Globulins	Serum globulins, fibrinogens and muscle myosin. It is soluble in dilute salt solutions. It is precipitated from solution by half saturation of ammonium sulphate. It is coagulated by heat.
(c)	Glutelins	Cereal proteins such as glutelins of wheat, oxyzenin from rice and zein of maize. It is soluble in weak acids or bases but insoluble in neutral aqueous solutions.
(d)	Gliadins (Proiamineii)	Gliadin from wheat and zein from corn. It is water insoluble but soluble in ethanol.
(e)	Protamineg	Salmine from salmon sperm cells contains high proportion of arginine.
(f)	Histones	Globulin in hemoglobin. It contains high proportion of basic amino acid. It is water soluble.

3. **Conjugated Proteins**

They are proteins which contain non-protein group (also called prosthetic group) attached to the protein part. On hydrolysis they give non-protein component and amino acid mixture.

Conjugated Protein = Protein part + Prosthetic group.

Conjugated protein are classified according to the nature of the non-protein group attached to the protein part.

			Prosthetic group	Example
1.	Nucleoproteins	=	Nucleic acid	Virus proteins Casein of milk (Serine residues are phosphorylated), ovovitellin of egg yolk.
2.	Phosphoproteins	=	Phosphoric acid	Mucin of saliva
3.		=	Carbohydrate or a deri-vative of carbohydrate	Serum lipoproteins.
4.	Lipoproteins	=	Lipids (Lecithin, Cephalin, cholesterol etc).	Biological oxidation reduction reactions Carbonic anhydraser, catalase cyctochrome oxidase

Derived Proteins

They are formed from simple and conjugated proteins by physical and chemical means.

1.	**Primary derived:**	Slight change with little or on cleavage of peptide bonds.
(a)	Protein:	Fibrin from fibrinogen.
(b)	Metaprotein:	They are soluble in dilute acids and bases but insoluble in neutral solvents.
(c)	Conjugated proteins:	Formed by the action of heat, alcohol, UV light, X-rays. Example cooked egg white and egg albumin.

2. **Secondary derived protein:** These are formed by the progressive hydrolytic cleavage of the peptide bonds of protein molecules. They are water soluble and are not coagulated by heat.

   (a) Proteoses
   (b) Peptones
   (c) Peptides

The products of partfal hydrolysis of proteins are often classified as derived proteins.

These proteins are formed as a result of various deep seated changes in the structure or composition of the proteins.

STRUCTURE OF PROTEINS

Proteins exhibit four levels of organisation:

Primary structure:	Refers to amino acid sequence.
Secondary structure:	Refers to folding of polypeptide chain into specific coiled structure which is repetitive in one direction.
Tertiary structure:	Refers to arrangement and interrelationship of twisted chain into a three dimensional structure.
Quaternary structure:	Refers to the association of different monomeric subunit into a composite polymeric protein.

METABOLISM OF PROTEINS

Proteins are the chief organic components of cellular structure and organization. Each animal species and each type of issue is characterized by its own specific kind of proteins. Proteins like carbohydrates and fats, serve as a source of energy for the body. The metabolism of proteins essentially is the metabolism of amino acids. Food proteins are digested to amino acids in the gastrointestinal tract, and these amino acids, then pass into the portal blood stream and to the liver. The liver removes a certain proportion of amino acids to supply its own needs and adds amino acids which it has synthesised to the blood. Moreover the tissue proteins are continually undergoing breakdown catabolism), which adds amino acids to the blood. The blood amino acids thus arise from Absorption, synthesis and Tissue catabolism and there by represent an amino acid pool which can be drawn upon for all purposes of protein metabolism. Each tissue of the body can take the specific amino acid from this part in the proper proportion and synthesizes them into the kinds of proteins required for growth, maintenance, and proper function.

Protein metabolism can be divided into main three sources of pathways namely

(i) **Absorption from Intestines**
(ii) **Breakdown for Tissue Proteins**
(iii) **Synthesis through Liver**

PROTEIN METABOLISM AT A GLANCE

Sources	Blood	Utilization	
Absorption from Intenstine	Amino Acids	Synthesis of Proteins	→ Structural tissue proteins → Plasma Proteins → Enzyme Proteins → Milk Proteins → Hormone Proteins
Breakdown of Tissue Proteins	Amino Acids	Synthesis of non-protein nitrogen compounds	→ Hormones → Choline creative → Purines & pyrimidines → Coenzymes → Glutathions → Melamins
Synthesis in Liver	Amino Acids	**Energy Production** ↓ Deamination in liver Ammonia → Urea (excreted in urine) + Keto acids → Glucose (glucose metabolism) → Acetyl CoA. Ketone bodies (Fatty acid metabolism)	

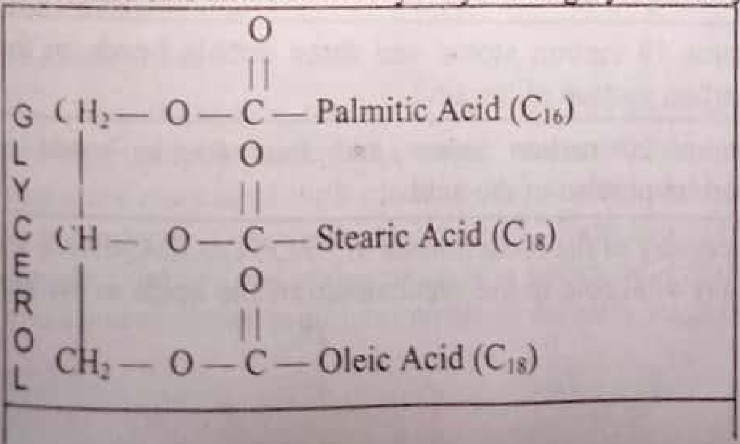
LIPIDS

Lipids are biological compounds that function in membranes, energy storage and transport, and insulation. Lipids can be extracted from biological materials using non-polar organic solvents. They are insoluble in water. These are composed principally of carbon, hydrogen and oxygen but differ from carbohydrates in having a much lower proportion of oxygen. They may also contain other elements particularly phosphorous and nitrogen. Lipids from protective and water repellent coatings at the surface of many organisms, and yet others act as chemical messengers both within and between cells.

The most abundant lipids are the simple lipids, which are formed by joining an alcohol and a fatty acid with a long hydrocarbon chain through an ester linkage.

Classification of Lipids: **Simple Lipids:**

They are esters of fatty acids with various alcohols. If the alcohol is glycerol, then they are called fats and chemically they are trighlyceraldehydes.


GLYCEROL
CH₂ — O — C — Palmitic Acid (C16)
CH — O — C — Stearic Acid (C18)
CH₂ — O — C — Oleic Acid (C18)
O
O
O

A Simple Lipid

Fatty acids are long hydrocarbon chain carboxylic acids. Waxes are also simple lipids and these are the esters in which both the alcohol and the fatty acids components have long hydrocarbon chains. Waxes are totally isolatable in water due to the non-polar nature of their hydrocarbon components. Oleyl alcohol in the chemical name of a typical wax.

If all the three fatty acids in the riglyceraldhyde are the same, then they are called simple triglyceraldechdes. If the fatty acids are different, then they are called mixed glyceraldehydes. In nature mixed triglyceraldehydes are more abundant than the simple trighceraldhydes.

Fatty Acids:

Fatty acids are long hydrocarbon chain carboxylic acids represented by the general formula R-COOH where 'R' is the hydrocarbon portion. Almost all of that naturally occurring lipids yield fatty acids upon hydrolysis. Some yield only one fatty acid per mole, others as many as three. Fatty acids occur in nature as esters.

General Characteristics of Fatty Acids:

(1) They are moncarboxylic acids.

(2) The hydrocarbon portion (R) of the carbosylic acid usually contains even number of carbon atoms.

(3) Odd number or carbon atoms containing 'R' group are very rare.

(4) The hydrocarbon chain of the carboxylic acid may be saturated or unsaturated.

(5) The unsaturated portion of the hydrocarbon pout of the carboxylic acid may be mono-unsaturated or polyunsaturated.

Polmitic and stearic acids are more common examples saturated fatty acids while oleic acid is prominent among the unsaturated carboxylic acids.

Unsaturated fatty acids have lower melting point than that of saturated fatty acids of same chain length. Fatty acids with odd number of carbon atoms occur in trace amounts in terrestrial and moraine animals.

Essential Fatty Acids:

These are those polyunsaturated fatty acids which are not synthesized in the body and hence have to be taken in the diet. They are:

(i)	**Linoleic acid:**	It contains 18 carbon atoms and two double bonds in the hydrocarbon portion of the acid.
(ii)	**Linolenic acid:**	It contains 18 carbon atoms and three double bonds in the hydrocarbon portion of the acid.
(iii)	**Arachidonic Acid:**	It contains 20 carbon atoms and four double bonds in hydrocarbon portion of the acid.

Essential fatty acids are necessary in the biosynthesis of PROSTAGLANDINS which are hormone like substances and play vital role in the metabolism of the lipids in the human body.

(2) Compound Lipids:

They are the esters of fatty acids containing mithogen base in addition to alcohol and fatty acids. Typical examples are: phospholipids, Lecithings, cephalins, cerbrosides, sulfolipids, Gngliosides and proteolipids.

(3) Derived Lipids:

These are those substances which are derived from simple and compound lipids on hydrolysis. These include fatty acids of various series like steroids, Bile acids and substances associated with lipids in nature such as carotenes, vitamin A, D, E and K.

METABOLISM OF LIPIDS

The metabolism of lipids includes the metabolism of fats, fatty acids, phospholipids, sterols and other complex lipids. The fats are of particular importance, because they represent the bulk of the stored energy producing food in the body. Lipids are water unsoluble and are therefore transported in the body in an aquous medium in combination with various specific proteins. This results in lipid protein complex called Lipoproteins. These lipoproteins consists of triglycerides or cholesterol esters and the central core is surrounded by a coat of unesterified cholesterol phospholipids and protein.

Phospholipids, cholesterol and glycolipids are not stared in the adipose tissues but are found in the various organs of the body as essential structural constituents.

Lipids in blood:

Lipids in blood are for the most part lipids in transport from sites of origin to sites of utilization or storage. The amount of lipid in the blood then is a variable quantity depending on a balance among production utilization and storage. Plasma lipid occur in four major forms which are:

(i) High or heavy density lipoproteins
(ii) Low density lipoproteins
(iii) Very low density lipoproteins
(iv) Chylomicrons

Plasma proteins are in dynamic state. They are being continuously synthesized and degraded with rapid exchange of both lipid and protein among themselves. Two enzymes leathin, cholesterol oxyl transpires and lipoproteins lipase play a significant role in the catabolism of lipid fraction of lipoproteins. The components that are necessary for the synthesis of lipoproteins are triglycerides, cholesterol, cholesterol esters, phospholipids and apoproteins.

Fat Absorption:

Fat absorption results in the transformation of intestinal products, monoglycerides and long chain fatty acids to a turbib, macromulision, of the lymph. These fat particles are transported associated with more or less protein and with variable amounts of phospholipid and cholesterol. The muscosal calls cells form triglycerides and other lipids from both diet digestion products and endogenous precursors. Mucosal cell synthesis and blood transport of formed and absorbed products constitute an early stage of lipid metabolism.

Dietary fat is digested by the action of panereatic lipae, present in the intestines. The lipase hydrolyses the triglycenides to 40% free fatty acids and glycerol, 50-57% meno and diglycerides and 3-10% is absorbed unchanged as triglycerides. The products of the hydrolysis of triglycerides are absorbed with the help of bile salts in the form of water soluble molecular aggregates called mixed micelles.

Higher fatty acids are largely utilized for the triglycerides synthesis inside the intestinal epithelial cells and carried as chylomicrons which are hydrophobic water soluble triglycerides covered with a layer of hychophile phospholipids, free and extended cholesterol and some proteins.

Role of the Liver:

The liver is an organ that is actively concerned with lipid metabolism. Plasma free fatty acids are rapidly taken up by the liver. In the fating state between 30 and 50 percent of the circulating FFA may be removed. The uptake is directly related to the level of circulating FFA. The liver does not utilized these acids for energy to the same extent as does muscle tissue but converts the FFA to triglycerides and phospholipids. These lipid are stored or released to the circulation.

CARBOHYDRATES:

Carbohydrates are the most abundant organic compounds in living organisms. They are a source of chemical energy for biological processes, are important structural components and, is combinations with other molecules, such as proteins and lipids, play an important role in recognition.

Composition of Carbohydrates:

Carbohydrates are composed of carbon, hydrogen, and oxygen with the general formula $C_n(H_2O)n$, when 'n' is the number of Carbon atoms; hence their name meaning hydrates of carbon carbohydrates are chemically defined as the polyhydroxy aldehydes and ketones and their polymers having hemiacetal glycosidic linkages.

Classification of Carbohydrates

Carbohydrates and classified into Monosaccharides. Oligosaccharides and polysaccharides.

Monosaccharides:

Monosaccharides consist of single polyhydroxy aldehyde or ketone unit which cannot be broken down to simpler substances on acid hydrolysis. They are also called as simple sugars.

Monosaccharides are further divided into:

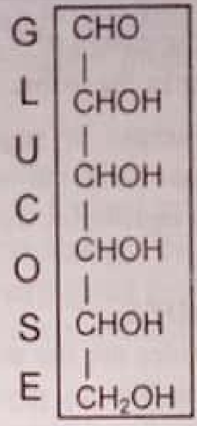
(i) Aldoses and

(ii) Ketoses

ALDOSES: Monosaccharides containing aldehydic group as the functional grouping are called aldoses. They are further classified according to the number of carbon atoms present. Monosaccharides containing three to seven carbon atoms are called Trioses, Tetroses, Pentoses, Hexoses and Heptoses respectively.

Typical examples are

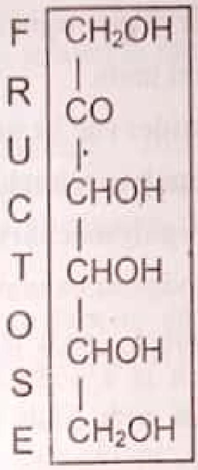
Erythrose
Ribose
Glucose
Galactose
Mannose



KETOSES: Monosaccharides containing ketonic group as the function grouping are called:

Typical examples are:

Xylulose
Ribose
Fructose



OLIGOSACCHARIDES

Oligosaccharides are arbiterarily efined as carbohydrates that contain two and ten monosaccharides units per molecule joined by glycosidic linkages. On hydrolysis they yield monosaccharide. Depending upon the number of constutient monosaccharide units, the oligosaccharides are called Sisaccharides, Trisaccharides, etc. Oligosaccharides are reducing sugars if one of the carbonyl group is free (not involved in glyeosidic linkage). The reducing power of the carbohydrates decreases as the number of their sugar component increases.

Disaccharides:

Disaccharides consist of two monosaccharides joined by a glycosidic linkage. The most important disaccharides are Maltose, Lactose and Sucrose. Maltose and Lactose are reducing disaccharides where as Sucrose in non-reducing disaccharide. In general the properties of disaccharides are similar to those of monosaccharides. Reducing disaccharide sugars are not as good reducing agents as monosaccharide because of the lower ratio of reducing groups to carbon atoms.

Maltose: It is also called as Malt Sugar. It consists of two molecules of D-glucose joined by (1,4)-glycer linkage. It does not occur in free state but is formed as an important transitory intermedrate product of the digestion of starch and glycogen.

Lactose: It is called Milk Sugar. Lactose consists of galactose and glucose joined by β(1,4)-glycosidic linkage. It is also called as glucose galactoside. It is an animal saccharides and it is present to the extent of 5 in milkonly. It is synthesized in mammary gland and during lactation may appear in the urine.

Sucrose: Sucrose or sugar cane is a plant disaccharide and it is present in high concentration in sugar cane and sugar beat. Sucrose is used for sweetening purpose. Sucrose on hydrolysis yields equimolecular amounts of glucose and fructose. It is also called an Inver Sugar.

POLYSACCHARIDES

Polysaccharides are the polymers of monosaccharide units which are joined in linear or braenched chain fashion by glycosidic linkages. Polysaccharides contain a large number of sugar components per free carbonyl group.

Polysaccharides have two important biological functions.

(1) As storage form of fuel. It is stored as Glycogen or starch depending upon the source as animal or plant origin respectively.

(2) As structural units.

Polysaccharides can be divided into two groups:

(a) Homopolysaccharides

(b) Heteropolysaccharides.

Two more popular example of polysaccharides are starch and cellulose.

Starch: Native starch is a mixture of two polysaccharides namely Amylose and Amylopectins starch is a nonreducing polysaccharide and gives blue colour with Iodine. Starch on hydrolysis with dilute mineral acids gives only glucose. Starches are digested by humans.

Cellulose: Cellulose is a linear polymer of D-glucose units joined together by β(1,4) glycosidic linkages. On partial hydrolysis, cellulose yields β–1,4 disaccharide celloboise instead of maltose. Cellulose is insoluble in water, it is non reducing and gives no colour with iodine.

Glycogen: Glycogen is the reserved carbohydrate of the body. It is also called as animal starch, because it serves as nutrional reservoir in animal tissues. It is soluble in water and has no reducing property. It gives red colour with iodine.

Dextrins: They are the partial hydrolytic products of starch by is β-amylase, β-amylase and acids.

Metabolism of Carbohydrates:

Metabolism may be defined as all the chemical process occurring within the cells of a living organism. Carbohydrates provide an immediate source of energy to the body. Carbohydrate metabolism in the animal body is essentially the metabolism of glucose and of substances related to glucose in their metabolic processes. The characteristic sugar of blood and tissue fluids is Glucose. The digestion of food carbohydrates such as starch, sucrose and lactose produces the mono-saccharides glucose, fructose and galactose, which pass into the blood stream. Galactose and fructose then are converted to glucose in the liver. The glucose of circulating blood and tissue fluids is drawn upon by all the cells of the body and used for the production of energy. Generally, carbohydrate metabolism supplies more than half of the energy requirements of the body. In fact, the brain mainly depends upon carbohydrate mechanism as source of energy and quickly ceases to function properly when the blood glucose level falls much below normal.

Role of Glycogen in the Metabolism:

The glycogen of lives, muscles and other tissues in formed primarily from glucose and serves as a source of immediately available or reserve energy. Normally much of the reserve fat in the body is formed from glucose. The mammary gland synthesizes lactose from blood glucose. Tissue glycolipids and mucopolysacchrides are also formed from glucose.

GLUCOSE – a key metabolic molecule:

The metabolism of many of the protein amino acids proceeds by the glucose pathway, and some of the products of glucose metabolism are utilized by the body for the synthesis of amino acids.

This endores the concept that glucose occupies the central position in carbohydrate metabolism, and that carbohydrate metabolism is intimately related to the metabolism of both lipids and proteins.

Disaccharides, such as sucrose, lactose and maltose, usually are completely hydrolyzed to the mono-saccharides in the process of digestion and do not enter the blood stream. Glycogen is the chief carbohydrate of tissues, just as glucose is of blood and other body fluids.

Main Metabolic Pathways: There are several metabolic pathways from which glucose can be utilized in the body, but the following are the three most important ones:

(i) **Conversion of Glucose to Glycogen.**

(ii) **Oxidation through Glycolysis followed by Krebs Citric Acid Cycle to yield metabolic intermediates and chemical energy in the form of ATP.**

(iii) **Oxidation via the Pentose Phosphate Pathway to yield ribose phosphate for nucleic acid synthesis.**

ENZYMES

Enzymes are biological cathalysts. They speed up the chemical reactions which go inside living things. Without them the reactions would be so slow that life would grind to a halt. Most of the enzymes are proteins in nature. An animal cell may contain up to 4000 different types of enzymes, each catalyzing a different chemical reaction. As catalysts, enzymes reduce the activation energy necessary for a reaction to occur at physiological temperature.

How fast the reaction may become?

Enzymes have extra-ordinary catalytic power. This can be explained by a simple reaction of carbon dioxide and water to form carbonic acid.

$$CO_2 + H_2O = H_2CO_3$$

In the absence of an enzyme, the reaction is very slow, perhaps producing only 200 molecules of carbonic acid per hour. In living cells, this reaction is catalyzed by the enzyme carbonic anhydase and 600,000 molecule of carbonic acid are formed every second, in other words, the enzyme catalyzed reaction proceeds some 10 million times faster.

[redacted]

Types of Enzymes:

Enzymes are made inside cells. Once formed, the enzyme may leave the cell and exert it action outside. Such enzymes are called extracellular. They include the digestive enzymes which break down food substances in our gut.

Other enzymes exert their action inside the cell. They are called intracellar enzymes. Their job is to speed up the chemical reactions occurring in our cells. But they do more than just speed up the reactions; they also control them. This is because every enzyme occurs in a particular place.

General Properties of Enzymes

(1) They are always proteins.

This is one reason why we need proteins in our food.

(2) They are specific in their action.

This means that each enzyme controls one particular reaction or type of reaction. Therefore, the enzyme maltose will only act on maltose, and sucrose on sucrose.

(3) They can be used over gain.

This is because their structure is not altered by the reaction in which they take part.

(4) They are destroyed by heat.

As enzymes are proteins, they are denatured by heat. Most of the enzymes stop working if the temperature rises above 45°C. However, certain microbes have enzymes which can work at high temperatures.

(5) They are sensitive to pH.

The term pH refers to the degree of acidity or alkanity of a solution. Most intracellular enzymes work best in neutral conditions. However, the digestive enzymes in the stomach work best in acid conditions, and those in small intestive work best in alkaline conditions.

Major Classes of ENZYMES

Six basic classes of enzymes can be distinguished by the types of chemical reactions they catalyse.

(1) Oxidoreductases

Oxidoreductases transfer electrons, usually in the form of hydride ions or hydrogen atoms. They are involved in the process of trapping the potential energy of chemical compounds by coupling their reactions with the formation of ATP molecules.

(2) Transferases:

Transferases are involved in the biosynthesis of cellular constituents. The transferase-catalyzed reactions involve assembly of complex molecules from simple ones, such as polysaccharides from monosaccharide triacylglycerols from fatty acids and glycerol and polypeptide chains from amino acids.

(3) Hydrolases:

Hydrolases break down substrates, such as esters, disaccharides, polysaccharides, polypeptides and nucleic acids into their molecular units. The enzyme chymothypsin catalysis the hydrolysis of peptide bond in proteins.

[redacted]

(4) **Lyases:**

Lyases act on substrates with C-C, C-O, C-N and other bonds by means other than hydrolysis or oxidation. Their activities include reactions that eliminate water, leaving double bonds or conversely, add water to double bonds.

(5) **Isomerases:**

Isomerases cause geometric or structural changes in a substrate molecule. Examples are glucose to fructose and galactose to glucose.

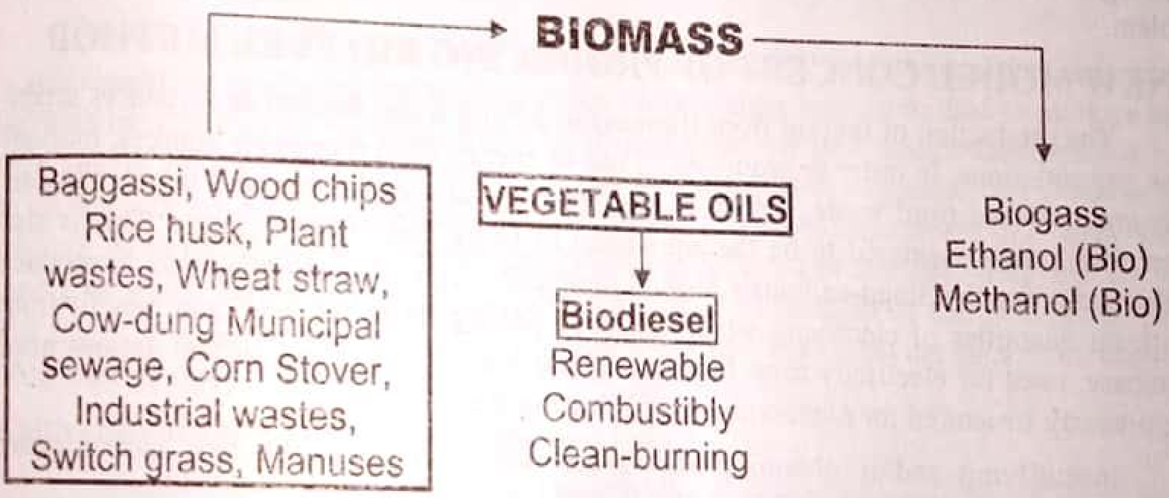
(6) **Ligases:**

Ligases join together two molecules and these reactions are energetically unfavourable and require an input of energy. This energy is provided by coupling the reaction with one that involves the breaking of the phrophosphate bond in ATP.

BIOFUELS

Biofuels: Biofuels are those secondary renewable fuels which are obtained by thermo chemical processing or bioconversion of Biomass especially carbonaceous waste materials. Methane and Ethanol are popular examples Biofuels. These are environment friendly.

Biomass: The organic matter contained in plants is called as Biomass. The energy found in the organic plant matter comes from sunlight. Some typical examples are wood, wood residence left over from the timber industry, crop residues, charcoal, manure, urban waste, industrial waste.


BIOMASS
Baggassi, Wood chips Rice husk, Plant wastes, Wheat straw, Cow-dung Municipal sewage, Corn Stover, Industrial wastes, Switch grass, Manuses
VEGETABLE OILS
Biodiesel
Renewable
Combustibly
Clean-burning
Biogass
Ethanol (Bio)
Methanol (Bio)

Preparation of Biodiesel: It is made by miring vegetable oil with a solution of methanol containing sodium hydroxide (xly) glycorine is removed as a waste product.

New Biofuels Processing Methods:

New methods are based on the thermo chemical Biomass conversion.

(i) **Direct Combustion:** (ii) **US Purox Gasification Process**

(iii) **Flash Pyrolysis Process** (iv) **Air Pyrolysis**

Fast-Hydropyrolysis-Hydrodeoxygnation Process:

In this method biomass alongwith hydrogen is fed into a high pressure reactor and subjected to extremely fat heating, rising at as hot as 900F is less than a second. This method is **CONCEPT BASED:**

How to make Biofuels

Biofuel is considered to be the most pure and the easiest available fuels on the planet. Also known as agrofuel, they are classified into gas, liquid and solid form derived from biomass. Most of the people would be very happy to know that most of the forms of biofuels can be easily manufactured even at in one's kitchen garden. One of the key features of biofuels is that they are better than other forms of fuels like petrol or diesel that is manufactured by most of the big oil manufacturing companies. Most of the diesel engines would work more efficiently and even last longer with the use of these home made biofuels. These fuels are also very clean and environment friendly. These biofuels can be a lot more economic if used in the kitchen for cooking purpose. These fuels also encourage the recycling process as most of them are manufactured from waste products.

There are various forms of biofuels and most of them are made through a detailed process having various staged. Most of the animal fats, vegetables and oils contain glycerin and are thus called triglycerides. In the process of manufacturing the biofuels, all the fats and oils are turned into esters, separating the glycerin. At the end of the process, all the glycerin sinks down at the bottom and oil the biofuel rests at the top. The process through which the glycerin is separated from the bio-diesel is known as transesterification. This process also uses lye as a catalyst in the whole process. Some of the chemicals which are used in the manufacturing of biofuels are ethanol or methanol which brings into use methyl esters. Methanol is derived from fossil fuels while ethanol is derived from plants. One of the advantages of using ethanol is that they can be distilled even at the home without any problem.

NEW MODEL CONCEPT OF PRODUCING BIO FUEL METHOD

The production of fuel oil from Biomass in getting wider interest as it reduces green-house gas emissions. In order to promotes its use of energy from renewable sources, biofuels are being produced from waste, residence, non-bond cellulosic material and lingo-cellulosic matter which are considered to be the equivalent of twice that of the biofuels. This is also worth mentioning that lingo-cellulosic biofuel production technologies are able to co-produce significant quantities of electricity which are once linking up to the grid, can benefit from repurchase, rates for electricity form biomass. These second generation biofuel options need to be property structured for overcoming the following obstacles:

(i) Indentifying and/or obtaining row plant matter that has the best carbohydrate concentration.

(ii) Developing economically viable grinding, pre-treatment and saccharification process for releasing the simple rugars that are contined is these carbohydrates.

(iii) Indentifying micro-organisms with a genetic heritage that makes it possible t ferment as much of these sugars as possible.

NEW MODEL CONCEPT OF PRODUCING BIO FUEL METHOD

The term **third** generation biofuel has only recently enter the mainstream and it refer to biofuel derived from algae. Previously, algae were lumped in with second generatio biofuels. However, when it became apparent that algae are capable of much higher yield with lower resource inputs than other feedstock, many suggested that they be moved to thei own category. As we can realize demonstrate, algae provide a number of advantages, but at least one major shortcoming that has prevented them from becoming a runaway success.

Fuel Potential of Third Generation Biofuels

When it comes to the potential to produce fuel, no feedstock can match algae In terms of quantity or diversity. The diversity of fuel that algae can produce results from two characteristics of the microorganism. First, algae produce an oil that can easily be refined into diesel or even certain components of gasoline. More importantly, however, is a second property in it can be genetically manipulated to produce everything from ethanol and butanol to even gasoline and diesel fuel directly.

Butanol is of great interest because the alcohol is exceptionally similar to gasoline. In fact, it has a nearly identical energy density to gasoline and an improved emissions profile. Until the advent of genetically modified algae, scientists had a great deal of difficulty producing butanol. Now, several commercial-scale facilities have been developed and are on the brink of making butanol and more popular biofuel than ethanol because it is not only similar in many ways to gasoline, but also does not cause engine damage or even require engine modification the way ethanol does.

The list of fuels that can be derived from algae includes:

- Biodiesel
- Gasoline
- Ethanol
- Jet Fuel
- Butanol
- Methane
- Vegetable Oil

Diversity is not the only thing that algae has going for it in terms of fuel potential. It is also capable of producing outstanding yields. In fact, algae have been used to produce up to 9000 gallons of biofuel per acre, which is 10-fold what the best traditional feedstock have been able to generate. People who work closely with algae have suggested that yields as high as 20,000 gallons per acre are attainable. According to the US Department of Energy, yields that are 10 times higher than second generation bio fuels mean that only 0.42% of the U.S. land area would be needed to generate enough biofuel to meet all of the U.S. needs. Given that the U.S. is the largest consumer of fuel in the world, that is saying something about the efficiency of algae-based biofuels.

Cultivation of Third Generation Biofuels

Another favorable property of algae is the diversity of ways in which it can be cultivated. Algae can be grown in any of the following ways:

- **Open ponds.** These are the simplest systems in which algae is grown in a pond in the open air. They are simple and have low capital costs, but are less efficient than other systems. They are also of concern because other organisms can contaminate the pond and potentially damage or kill the algae
- **Closed-loop systems.** These are similar to open ponds, but they are not exposed to the atmosphere and use a sterile source of carbon dioxide. Such systems have potential because they may be able to be directly connected to carbon dioxide sources (such as smokestacks) and thus use the gas before it is every released into the atmosphere.

- **Photobioreactors.** These are the most advanced and thus most difficult systems to implement, resulting in high capital costs. Their advantages in terms of yield and control, however, are unparalleled. They are closed systems.

Note that all three systems mean that algae are able to be grown almost anywhere that temperatures are warm enough. This means that no farm land need be threatened by algae. Closed-loop and photobioreactor systems have even been used in desert settings.

What is more, algae can be grown in waste water, which means they can offer secondary benefits by helping to digest municipal waste while avoiding taking up any additional land. All of the factors above combine to make algae easier to cultivate than traditional biofuels.

Third Generation Biofuel Feedstock

One of the major benefits of algae is that they can use a diverse array of carbon sources. Most notably, it has been suggested that algae might be tied directly to carbon emitting sources (power plants, industry, etc.) where they could directly convert emissions into usable fuel. This means that no carbon dioxide would be released from these settings and thus total emissions would be reduced substantially.

As with everything, algae have a downside. In this case, the downside is large and if it cannot be solved, is a deal breaker. Algae, even when grown in waste water, require large amounts of water, nitrogen and phosphorus to grow. So much in fact that the production of fertilizer to meet the needs of algae used to produce biofuel would produce more greenhouse gas emissions than were saved by using algae based biofuel to begin with. It also means the cost of algae-base biofuel is much higher than fuel from other sources.

This single disadvantage means that the large-scale implementation of algae to produce biofuel will not occur for a long time, if at all. In fact, after investing more than $600 million USD into research and development of algae, Exxon Mobil came to the conclusion in 2013 that algae-based biofuels will not be viable for at least 25 years. What is more, that calculation is strictly economical and does not consider the environmental impacts that have yet to be solved.

A minor drawback regarding algae is that biofuel produced from them tends to be less stable than biodiesel produced from other sources. This is because the oil found in algae tends to be highly unsaturated. Unsaturated oils are more volatile, particularly at high temperatures, and thus more prone to degradation. Unlike the fertilizer requirements above, this is a problem that has a potential solution.

NEW METHOD FOR DRYING MICROALGAE CHEAPENS BIODIESEL PRODUCTION

By applying a technique for drying the algae, scientists from the biotechnology group managed to reduce by more than one-third the breeding ground of these organisms without increasing energy expenditure in the process of obtaining biodiesel, One problem that occurs during the production of biofuels is the low concentration of microalgae cultures, that is to say, there is plenty of water and few producing organisms.

To improve this concentration, scientists managed to eliminate the volume of water until microorganisms dry forming a kind of paste (biomass) that later will be subjected to various treatments to obtain biofuel.

The reduction of the culture medium facilitates the work in the later stages of the process, and the lesser amount of material to be processed leads to a cut in power spending and in the equipment used, Descubre Foundation reveals in a press release.

The new technique patented by UAL is an alternative to centrifugation, which is the usual dehydration process.

"It is a fact that centrifugation entails a higher energy expenditure than that generated by the biodiesel itself, so it is not a viable solution," says Tania Mazzuca, head researcher of this project.

"Moreover, it is a contradiction to produce clean energy using other conventional, not so green methods," the scientist added.

One advantage of the developed process is that glycerol, which is one of the products obtained when converting the algae oil to bio-fuel is used to "dry" the algae through an osmosis process.

This not only increases the sustainability of the manufacturing process, but also reduces its cost.

The researchers found that in tests conducted to demonstrate the effectiveness of the patented technique, over a third of the culture medium is removed in the first hour of the process.

Moreover, after two hours the reduction is between 55 and 65 per cent.

EXERCISE

Q. What is a cell membrane?

Ans. A cell membrane is composed of protein and lipid molecules forming a semi permeable membrane, which is actively selective in its functions — it allows the solvent molecules to pass but does not allow the passage of solute molecules.

Q. Describe the roles of Ribosomes and Centrioles in a cell?

Ans. The ribosomes (endoplasmic reticulum) are mainly associated with the synthesis of proteins.

The centriole serves to initiate the process of cell division.

Q. Describe Golgi apparatus in a cell.

Ans. The Golgi apparatus is concerned with secretary processes in a cell.

Q. Define Tissue. What are the main types of tissues in the body?

Ans. A tissue is a collection of cells having similar structure and functions. There are five main types of tissues in the body — epithelial connective, muscular, nervous tissue and the blood.

Q. How many types of muscles are there in human body?

Ans. There are three types of muscles-striated (Voluntary), unstriated (Involuntary or smooth), and cardiac muscles

Q. What is meant by Fatigue?

Ans. Fatigue is defined as progressive and temporary loss of irritability in a muscle due to its continuous stimulation.

Q. Name the important parts of a flower?

Ans. Flower is the reproductive part of a plant and its important parts are:

(i) Calyx *(ii)* Corolla

(iii) Androecium *(iv)* Gynaecium

Q. Differentiate clearly between Pollination und Fertilization?

Ans. Both terms are involved in the reproduction processes. Pollination may be defined as a process in which the transfer of pollen takes place from male reproductive organ to female reproductive organ in flowering plants, usually through some biological agent (animals, birds, insects etc.) fertilization is a process in which fusion of egg and sperm takes place when they come close together.

Q. Define Transpiration?

Ans. It may be defined as a process in which excess amount of water absorbed by the plant through its roots, is given off in the form of water vapours. It is not a case of simple evaporation hut it is regulated by protoplasm.

Q. What are the essential parts of a plant?

Ans. The essential parts of a plant are roots, stem, leaf and flower.

Q. **Name some unicellular plant and animal?**

Ans. Unicellular plant —Chlamydomonas.

Unicellular animal----Amoeba.

Q. **Name two main types of flowering plants?**

Ans. They are called Monocots and Dictos. The main basis of classification is that the monocots have only one cotyledon in their seed pod. Dicots have two.

Q. **How is water transported in plants?**

Ans. Plants require water to grow. They cannot get this water unless it is available in the soil. Plants obtain water from the soil through their roots. It then passes up the stem to the leaves and flowers. The plant does not take all the water available in the soil. Much of the remaining water evaporates into the surrounding air.

Q. **Differentiate clearly between Photosynthesis and Respiration?**

Ans. **PHOTOSYNTHESIS:**

Photosynthesis is the process taking place in plants which uses carbon dioxide and water to make sugars. Sunlight light is needed for photosynthesis to occur, so it takes place only during the day. The green pigment, chlorophyll, is also needed as a catalyst for photosynthesis. The sugar produced during photosynthesis is transported from the leaves by phloem vessels to all parts of the plant where it is used in respiration, or it is stored as starch for later use in respiration.

RESPIRATION:

Respiration is the process in plants and animals which provides the energy for all other processes which must continue for the organism to live. Respiration is the reverse, of photosynthesis, in that it uses sugar and oxygen in the production of energy and produces carbon dioxide and water as waste products.

Q. **List the minerals used for the nutrition in plants?**

Ans. Potassium, Magnesium, Nitrogen and Iron.

Q. **Name some important cycles in nature?**

Ans. The carbon cycle, the water cycle, the rock cycle, the nitrogen cycle and the energy cycle.

Q. **Describe the major groups of the Plant Kingdom?**

Ans. The plant kingdom is divided into three major groups — Algae, Bryophytes and Tracheophytes.

Q. **Give the Classification of Human?**

Ans.

Kingdom	Animalia
Phylum	Chordata
Sub-Phylum	Vertebrata
Order	Primate

Family	Honinidae
Genus	Homo
Species	Sapiens

Q. **What is meant by pH? Give some examples?**

Ans. It is a scale of acidity and pH is defined as the negative logarithm of the hydrogen ion concentration. Mathematically, pH = -log $[H^+]$

the range of pH varies from 0 to 14.

pH value	01 2 3 4 5 6	7	8 9 10 11 12 1314
Characteristics	Acidic	Neutral	Basic

The pH value of some useful fluids is given below:

Distilled water = 7.0
Blood= 7.4
Gastric Juice = 0.9 – 1.0
Intestinal Juice = 7.5 – 8.0
Urine = 5.5 – 6.5

Q. **Define buffers and describe their importance in the human body?**

Ans. Buffers are aqueous solutions which resist changes in their pH when small amounts of acids or alkalies are added to them. They act like shock-absorber against the sudden changes in pH. Buffer solution is usually a mixture of weak acid and its salt with a strong base. Buffer solution in the human body regulates the pH of the body fluids and also controls the pH in chemical reactions catalyzed by enzymes. A typical body buffer is a mixture of carbonic acid and sodium bicarbonate.

Q. **What is the importance of Iron in the human body?**

Ans. Human body contains about 3 to 4 gm of iron and 75% of it is found in blood. Iron is a component of haemoglobin, myoglobin, the cytochromes and certain other enzyme system. Hence function of iron in the body is "Oxygen transport" and cellular respiration.

Q. **What is Haemoglobin?**

Ans. It is a complex organic compound containing an iron atom at the centre. It belongs to a class of conjugated proteins. It is made up of Home and ferrous Protoporphyrin.

Q. **What is the importance of Iodine in the human body?**

Ans. Iodine is a constituent of thyroxine, the active principle of thyroid gland. Thyroid plays an important role in the energy metabolism and in the growth of the body. An adult body contains about 50 mg of iodine. Sea foods are rich in iodine.

Q. **What processes operate in Basal Metabolism?**

Ans. Respiration, blood circulation, digestion, excretion and maintenance.

Q. **Define Osmosis?**

Ans. Movement of solvent molecules from a pure solvent to a dilute solution through a semi permeable membrane is called Osmosis.

Q. **Differentiate clearly between Isotonic, Hypertonic and Hypotonic solutions?**

Ans. Isotonic solutions have the same osmotic pressure as within the cell. Hypertonic solution has the higher and hypotonic solution has the lower osmotic pressure than within the cell.

Q. **What is meant by Balanced Diet?**

Ans. Balanced diet is one which contains all the essential nutrients of food in proper proportions so as to provide energy and nutritional requirements for growth and reproduction.

Q. **What is the average calorie requirement of a normal adult person?**

Ans. It ranges between 2500-4000 K. Cal. depending upon the nature of his work.

(i) Sedentary (2500 K. Cal.)

(ii) Light work (3000 K. Cal.)

(iii) Moderate work (3500 K Cal.)

(iv) Heavy work (4000 K. Cal.)

Q. **What is meant by BMR?**

Ans. BMR stands for Basal Metabolic Rate. It is the amount of energy required just to maintain the body processes when a person is at complete rest.

Q. **What is Satiety?**

Ans. Apatite is a desire for food and satiety is a lack of desire to eat more.

Q. **Define Pasteurization? Give its advantages?**

Ans. Pasteurization is a preventive measure of public health importance just like modern principle of supplying safe water. It was discovered by French Scientist Louis Pasteur. This process delays the natural souring of milk by 2 to 24 hours. It also kills some specific harmful organisms. The process involves rapid heating of the milk under pressure from 125°C to 150°C for a few seconds only which is then rapidly cooled and bottled. It preserves taste, flavour, appearance and digestibility.

Q. **Why is milk considered an ideal food?**

Ans. It is so, because it contains almost all the nutrients needed in a well-balanced diet, except vitamin C.

Q. **In what ways Proteins differ from Carbohydrates?**

Ans. Proteins differ from carbohydrates because they contain 16% nitrogen. Moreover protein molecules are larger in size.

Q. **What are the specific functions of Fats in the human body?**

Ans. Fat contains carbon, hydrogen and oxygen and is composed of fatty acids. Fats are utilized in the body for:

(i) Padding around the organs.

(ii) Protection of nerves.

(iii) Insulation of the body against rapid temperature changes.

(iv) Carriers of fat soluble vitamins.

(v) Concentrated source of energy.

Q. **How do you compare animal proteins with that of vegetable proteins?**

Ans. Animal proteins are considered as superior to vegetable proteins because they are rich in essential amino acids and hence preferred. Animal proteins are called first class and vegetable proteins, second class proteins.

Q. **What are essential amino acids?**

Ans. Essential amino acids are those amino acids which cannot be synthesised by the body and hence have to be included in the diet from outside. They are 8 in number and their names are:

Isoleucine, Leucine, Tryptophan, Threonine, Phenylalanine, Valine, Methionine and Lysine.

Q. **How are proteins classified?**

Ans. Proteins are classified into simple and conjugated proteins.

Q. **Why is an egg important food for growth?**

Ans. Egg proteins are best in quality and are taken as standard for comparing the quality of other food proteins. Egg proteins are better digested, absorbed and utilized by the body than proteins of meat or milk.

Q. **What are the functions of Cholesterol?**

Ans. Cholesterol is an important tissue component. It has a number of functions to do in the human body like:

(i) Insulation of nerves and brain structure.

(ii) Transportation of fatty acids in the body.

(iii) Production of sex hormones.

(iv) Production of pro-vitamin D.

(v) Production of precursor of cholic acid.

Q. **Differentiate between Starch and Cellulose?**

Ans. Starch is a carbohydrate (polysaccharide) and it contains two components:

(i) Amylose

(ii) Amylopectin

Starch is completely utilized by the human body. Cellulose is also a carbohydrate (polysaccharide). It is made of glucose units which are linked by (b-1, 4) glycosidic linkages. It is not utilized by the human body because the enzyme responsible for its metabolism is absent in the human body.

Q. **Differentiate clearly between Starch and Glycogen?**

Ans. Both, starch and glycogen are carbohydrates and polysaccharides but starch has plant and glycogen has animal origin. Moreover, glycogen is more highly branched than starch.

Q. **What are Pro-vitamins?**

Ans. These are those substances which as such do not possess vitamin activity but on conversion give rise to vitamins. Pro-vitamins of vitamin A are carotenes.

Q. **What are the daily requirements of vitamin A, D and C?**

Ans.

Vitamin A	5000IU
Vitamin D	400 IU
Vitamin C	60 mg.

Q. **What is the other name of Vitamin C?**

Ans. Ascorbic acid.

Q. **What are Lipids and how are they classified?**

Ans. Lipids are ester like compounds of fatty acids which are insoluble in water but are soluble in fat solvents. Lipids are classified into:

(i) Simple lipids
(ii) Compound lipids
(iii) Derived lipids.

Q. **What is Glycolysis?**

Ans. It is a chemical leads process in which the break down of glucose occurs to pyruvic or lactic acid for motion.

Q. **What is Citric Acid Cycle?**

Ans. Citric acid cycle is the common pathway for the metabolism of carbohydrates, fats and proteins since it provides the complete oxidation of acetyl coenzyme A to carbon dioxide and water.

Q. **Define saponification?**

Ans. Hydrolysis of a fat by an alkali is called saponification. Commercially this reaction is used in the preparation of soaps.

Q. **What are Bile Salts? Give their importance?**

Ans. Bile salts are sodium and potassium salts of glycopholates and these are powerful emulsifying agents and therefore they lower the surface tension of the media and thus aid in the absorption of fats.

Q. **What are Dextrins?**

Ans. Dextrins are the partially degraded breakdown products of starch.

Q. **Which hormones keep the blood sugar level high?**

Ans. These are the following hormones:

(i) Glucagon
(ii) Epinephrine
(iii) Adrenal cortex hormones
(iv) Growth hormone and ACTH
(v) Thyroid hormone

Q. **What is Insulin? Give its important functions in the human?**

Ans. Insulin is a hormone secreted by the pancreas in the human body. Chemically it is a protein containing polypeptide linkages of amino acids. It regulates the blood sugar level. Its specific biological functions in the human body are:

(i) It promotes the entry of glucose in all the tissues of the body except liver.
(ii) It helps in glycogenesis.
(iii) It prevents glycogenolysis.

(iv) It inhibits glucogenic enzymes.

Q. What are Enzymes?

Ans. Enzymes are biological catalysts and these are protein in nature.

Q. What are isoenzymes? Give two examples?

Ans. Isoenzymes are the multiple forms of the same enzyme. Examples are: Lactate dehydrogenase, Alkaline phosphatase.

Q. What is Exothermic and Endothermic Reaction?

Ans. If the heat is liberated during the process (oxidation), it is called exothermic reaction, and if heat is consumed during the process, it is termed as endothermic reaction.

Q. What are the main sources of energy liberation in the human body?

Ans. These are high and low energy liberation phosphates. The high energy phosphates are ATP, creative phosphate ADP and acetyl phosphate. The low energy phosphates are glucose-1-phosphate and glucose-6-phosphate.

Q. What is hypoglycaemia?

Ans. Hypoglycaemia is fall of blood sugar level below its normal limit. The symptoms of hypoglycaemia are usually felt when blood sugar level falls below 40% mg.

Q. What are the main functions of amino acids?

Ans. Amino acids take part in active growth process in growing children, pregnant and lactating females and convalescents. These are utilized to replace daily wear and tear of the body tissues and are essential constituents of cell protoplasm.

Q. What are the effects of Hypoglycaemia?

Ans. Brain being very sensitive to blood sugar levels is mainly affected. There is mental confusion, giddiness, visual disturbances, syncope, coma and convulsions.

Q. Describe the nature of human body fat?

Ans. It mainly occurs as neutral fat in the form of triglycerides of oleic (75%), plamitic (20%) and stearic (5%) acid. There are some other forms of fat besides neutral fat, and these are sterols (cholesterol), steroids and phospholipids. Lecithin, cephalin and sphingomyelin are examples of phospholipids.

Q. What is Ketosis?

Ans. The condition in which there are increased ketone bodies in blood (Ketoanemia) and urine (Ketonuria) is called Ketosis.

Q. What are the symptoms of Vitamin A toxicity in adults?

Ans. Vitamin A toxicity is caused by ingestion of mega doses. Symptoms are air loss, dry scale skin, hyperkeratosis, joint and bone pains, easy fatigue and insomnia.

Q. What is Carbon Cycle?

Ans. Carbon from the atmosphere in the form of carbon dioxide is incorporated in green plants by photosynthesis, and oxygen is produced as a byproduct. Sugar and starches are produced during the **process** of photosynthesis form carbon dioxide and water in plants. When these plants are eaten by bacteria, the oxygen recombines with the organic material to give carbon dioxide which is again set free of course; part of the glucose is oxidized by the plant itself.

Q. Describe the Nitrogen Cycle?

Ans. Nitrogen cycle is actually the fixation of atmospheric nitrogen in the biosphere. It involves the circulation of nitrogen compounds in nature through the various organisms to which nitrogen is essential. Organic nitrogen compounds, in the soil are taken in by plants, and are combined by the plants with other elements to form nucleic acids and proteins. The result of animal waste and decay is to bring the nitrogen that the animals had absorbed back into the soil in the form of simple nitrogen compounds. Bacterial action of various, kinds converts these into compounds suitable for use by plants again. In addition to this main circulation, certain amount of atmospheric nitrogen is fixed (combined) by the action of bacteria associated with the roots of leguminous plants, and by the action of atmospheric electricity; while some combined nitrogen is set free by the action of denitrifying bacteria.

Q. Differentiate clearly between Infection, Inflammation and Allergy?

Ans. **Infection:** It is said to have accused when a body is invaded by pathogens causing disease.

Inflammation: It is a state in which a series of changes occur in the tissues indicating their reaction to injury, whether mechanical, chemical or any other.

Allergy: It is hypersensitiveness to some foreign protein, small doses of which produce bacteria. The cardinal signs are heat, swelling, pain and redness, a violent reaction in the patient. Asthma and hay-fever are allergic states.

Q. Give the names of some famous animals along with their habitats?

Ans. These are described in the following chart.

ANIMALS AND THEIR HABITATS

NAME OF ANIMAL	CLASSIFI-CATION	HABITAT AND CHARACTERISTICS
Kiwi	Bird	It is a flightless bird, has long bill, stout leg, rudimentary wings, and found in New Zealand.
Koala	Mammal	It is an Arboreal Marsupial mammal. It is about 2-ft. long, has large hairy ears, grey fur and sharp claws. Found in Australia.
Kangaroo	Mammal	Marsupial mammal. Herbivorous, small head, large ears, long powerful thin legs, a long thick tail and small forelegs. Found in Australia.
Emu	Bird	Swift running flightless bird, smaller and undeveloped wings. Found in Australia.
Platypus	Mammal	Small flat-footed aquatic mammal, fleshy bill (like a duck), dense fur, webbed feet, broad flattened tail. It is one of only two mammals in the world which lay eggs. Found in southern and Eastern Australia and Tasmania.
Crocodile	Reptile	Large Voracious thick skinned long bodied aquatic reptile. Found in Africa.

Penguin	Bird	An erect short-legged flightless aquatic bird. Found in southern hemisphere, found in Antarctica.
Alligator	Reptile	Long aquatic reptile, broad head and a special pocket in the upper jaw. The tail is specially flattened for swimming, and the nostril is placed high on the snout so that it can breathe even when lying partly submerged in water. Found in lakes, swamps and rivers of southeastern North America.
Jaguar	Mammal	A large cat of Tropical America that is large and stockier than the Leopard and is brownish yellow or buff with black spots.
Cobra	Reptile	Hooded snake, venomous, it expands the skin of the neck into a hood by the movement of anterior ribs, it is found in the countryside and towns of the warm parts of Southern Asia.
Polar Bear	Mammal	It is a large creamy white bear found in Arctic region.
Rhinoceros	Mammal	A large powerful herbivorous thick-skinned mammal has one or two upright horns on the snout. Found in the savannahs of Africa.
Ostrich	Bird	it is a swift-footed 2-towed flightless bird. It is the largest bird. It has valuable wings and tail plumes. Found in plains and deserts of Africa.
Walrus	Mammal	It is a marine mammal related to seals. It is hunted for the tough heavy hide and the worry tusks. Found in the Northern Sea: Arctic ocean to the north. Atlantic ocean. It uses its tusks to scope up shellfish from the ocean floor.
Tapir	Mammal	It is a large inoffensive horse like animal. Found in swampy forests of Southeast Asia.
Hippopotamus	Mammal	It is a large Herbivorous 4-toed aquatic mammal. Extremely large head and mouth, bare and very thick skin and short legs. Found in Africa.
Blue Whale	Mammal	It is a very large aquatic mammal. Length is usually more than 100 ft. Found in all oceans, warm or cold.
Gorilla	Primate	It belongs to the group of 'great apes'. It is most closely related to man. Length is about 6 feet. Found in African rain forests.
Chimpanzee	Primate	Great ape, found in equatorial Africa.
Panda	Mammal	A long tailed Himalayan carnivore, long black and white fur, found in mountains and bamboo forests of Central China. It is not a bear.
Manatee	Mammal	It is a tropical aquatic herbivorous mammal measuring about 16 feet in length. Found in coastal seawaters and rivers of western Africa, southeast U.S. West Indies and South America.
Shark	Fish	It is a very large marine fish, fusiform body, tough, rough grey skin, typical predator. Found in oceans Worldwide.
Killer Whale	Mammal	It is the largest dolphin, carnivorous, eats warm-blooded sea mammals, also called Orcas. Found in all oceans of the World. Killer Whales usually hunt in groups called pods.

HUMAN PHYSIOLOGY

INTRODUCTION

The word *physiology* is derived from the Greek words **phusis** (nature) and **logos** (a discourse). This term is generally applied only to the study of the functions of living beings. Human physiology deals with the study of man in terms of life processes of the human body. The human body is made up of 206 bones, 600 muscles, 60 thousand miles of capillaries of blood and 60 trillion human cells — the human body contains the most complicated mechanism, it is miraculous in character. There are more than 6 billion people on the surface of the Earth and not a single person duplicates, not even the twins. This is due to the unique assemblage of countless human cells and their patterns and different structural sequences of DNA molecules in each person.

SYSTEM OF THE HUMAN BODY

(A) The Skeletal System:

The bony skeleton supporting the human body is constricted to strengthen the muscles which produce movement in the body to give its shape. Bone is as strong mild steel and is lighter. There are 206 bones of various sizes in an adult. These bones are connected together in such a manner so as to form joints or articulations and are bound firmly together at these joints by strong white fibrous bonds called Ligaments. In the parts of the body, where an elastic and yielding substance is required, which is at the same time very rung, cartilage or gristle takes the place of bone, as in the more prominent part of the nose. The Backbone, vertebral column or spinal column is the central portion of the osseous system, it consists of a series of bones called vertebra and forms a kind of axis with which all the other parts of the skeleton are connected.

Central Build up of the Human Body and it's Important Parts (Out Line)

BODY
Head
Trunk
Limbs

System of the Human Body	
1.	The Skeletal System
2.	The Muscular System
3.	The Digestive System
4.	The Excretory System
5.	The Respiratory System
6.	The Circulatory System
7.	The Nervous System

Head
Skull
Frontal bone
Zygomatic bone
Nasal bone
Maxilla bone
Mandible
Collar bone

Sense Organs
Ear
Eye
Nose
Tongue
Skin

Blood
Plasma
Red Corpuscles
Colourless Corpuscles
Water
Veins
Arteries
Capillaries

Organs of the Abdomen
Oesophagus
Liver
Pancreas
Spleen
Stomach
Kidneys
Intestines
Bladder

HUMAN SKELETON

The most devious division of the Human Body is into head. Trunk, and Limbs or Extremities. The Osseous system consists of a large number of bones, which constitute the skeleton, and formal strong framework, which supports and protects the softer structures of the body.

HEAD (SKULL) **Cranium (8 bones)** The bones are United by means of irregular saw like edges.	1. Occipital 1. Parietal	1. Occipital 1. Parietal	1. Occipital 1. Parietal
Face (14-Bones) The face forms the front and lower portion of the skull.	2. Nasal bones 2. Lachrymal bones 2. Molar (Cheek bones) 2. Maxillary bones	1. Mandible bone 2. Fatal bones 1. Vomer bone 2. Turbinated bones.	
TRUNK **Vertebral Column (Backbone)** (Spinal Column) It is the central portion of the osseous system. It is composed of a series of bones (33) called vertebrae, and forms a kind of axis with which all the other parts of the skeleton are connected.	NECK: 7 Cervical Bones	These are the seven highest vertebrae belonging to neck, and used in the movement of the neck.	
	BACK: 12 Dorsal Bones	The next twelve Vertebrae belong to the back and support the ribs. These are called as Dorsal bones.	
	LOINS: 5 Lumbar Bones	The remaining five movable vertebrae belong to the Loins, and are called Lumbar vertebrae.	
	SACRUM: 5 Sacral Bones	The lowest lumbar vertebra rests on the broad surface of a kind of curved wedge, formed by the next 5 vertebrae fused together into one firm mass of bone. This wedge is called the Sacrum.	
	COCCYX: 4 Coccygeal Bones	The lowest and narrowest part of sacrum is attached to the coccyx which consists of 4 imperfectly formed vertebrae.	

CLAVICLE:	(Collar Bone)	There are two collar bones, called clavicles at the base of the neck and in front of shoulders.
SCAPULA:	(Shoulder Bone)	There are two shoulder bones; each called a scapula, at the top of the back. It is a large flat triangular shoulder blade.
STERNUM:	(Chest Bone)	It is a long flat and soft bone to which the ribs are attached. The lower part of the Sternum is formed of flexible mass

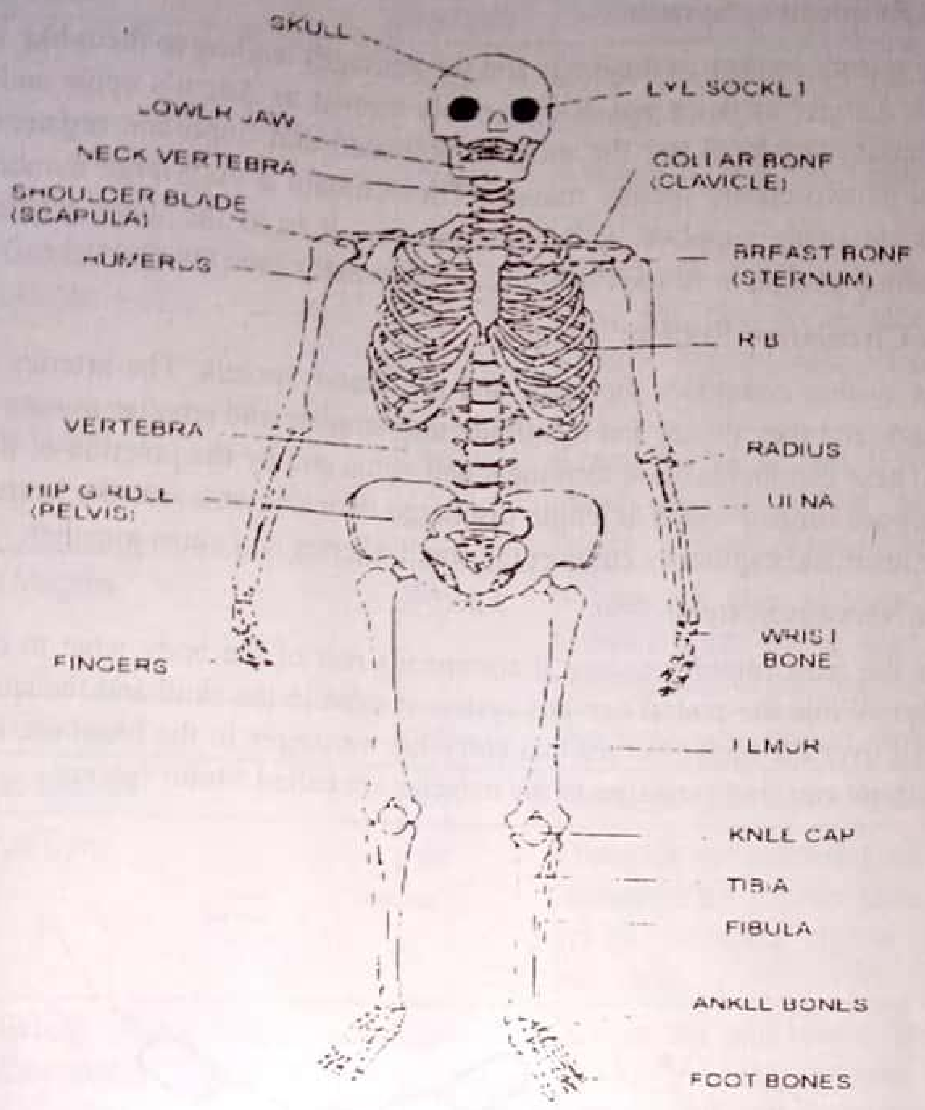
RIBS:	The ribs form a kind of bony cage to protect the heart and lungs. These are 24 in number, 12 on each side, being attached at the back to the backbone.
PELVIS:	The sides of the Sacrum are united with the two large hip-bones, and form a basin-like cavity called the Pelvis.
Humerus	It is the bone of the upper arm. It is very strong and consists of a long portion called the shaft, and two enlarged extremities called the Heads.
Ulna	It is a bone of the fore-arm. It extends from elbow to Wrist it is thick at its upper extremity which forms a hinge joint.
Radius	It is the second bone of the fore arms. It also extends from the elbow to the Wrist.
Carpal	The Wrist is composed of eight small bones, called carpal bones.
Metacarpal, Phalanges	Five long bones, called metacarpal bones form the plane of hand. Phalanges are finger bones. These are 14 for each hand.

LOWER LIMBS (BOTH LEGS) I

Femur	It is thigh-bone larger and stronger. It bears the weight of the body.
Patella	It is the Knee-cap and protects the Knee-joint.
Tibia	It is also called the calf-bone, or the skin bone. It is like a shaft.
Fibula	It is the second calf-bone fixed to the Tibia at both ends.
Tarsal	It is the ankle bone. These are seven in number.
Metatarsal Phalanges	Metatarsal bones are 5 in number and connected with the phalanges. Phalanges are Toe bones and are 14 in number.

(2) The Muscular System:

The bones of the skeleton are all surrounded by more or less flesh or muscle. Each muscle is composed of bundles of fibres capable of contraction when required. Muscles are of two types — voluntary and involuntary. The former are under the control of the will, while the latter are not. Face and limbs contain voluntary muscles while that of the heart and stomach contain involuntary kind. Those muscles which move the bones are connected with them by strong white fibrous masses called Tendons. The erect position of the human body is maintained by the combined influence of large number of muscles acting at the same time.



(3) **The Digestive System:**

It is a long system and involves mouth, oesophagus, the stomach, the liver, the pancreas, the small intestine and the large intestine. Saliva is an alkaline fluid secreted in the mouth and the digestion of food starts in the mouth itself. The oesophagus is the narrowest portion of the alimentary canal. Gastric juice secreted by the stomach is made up of hydrochloric acid, salts, pepsin and water. The changing of food into chyme by the gastric fluid is called chymification. The average time to produce this change is from 3 to 4 hours. The food is then passed on to the small intestine and then to the large intestine. Muscles play an important part in digestion. They keep the walls of the stomach and small intestine moving. This mixes the food and digestive juices inside, speeding up digestion (see the chart).

(4) **The Excretory System:**

It is also termed as the sanitary system of the body. It comprises the kidneys, skin, lungs and bowels. The system is designed to help get rid of the waste matter in the body when all juices have been extracted from the digested food. Lungs can also be added to this system. The kidneys, two in number, are important blood-purifiers. They separate a poisonous substance called urea from the blood.

(5) The Respiratory System:

This system comprises the lungs and the passages leading to them like larynx, trachea or wind-pipe. Larynx or voice box is commonly known as Adam's apple and can easily be felt in the throat. The lungs are the most complicated and important organs of respiration. They consist of two elastic spongy masses. They contain a very large number of small air cavities and are richly supplied with blood vessels. It is in the lungs where the blood is aerated by being brought in contact with the air we breathe (see the chart).

(6) The Circulatory System:

This system comprises the heart and the blood vessels. The arteries convey blood from the heart, and they divide and subdivide into smaller and smaller minute vessels called capillaries. These capillaries unite forming small veins and by the junction of these, larger and larger vessels are formed which at length discharge their contents into the hearts. Veins bring blood to the heart and capillaries connect the small arteries and veins together.

(7) The Nervous System:

It is the most important since it commands rest of the body what to do and how to work together. While the central nervous system resides in the skull and the spine, the nerves are spread all over the body. Nerves that carry the messages in the brain are called Sensory Nerves and those carrying messages to the muscles are called Motor Nerves.

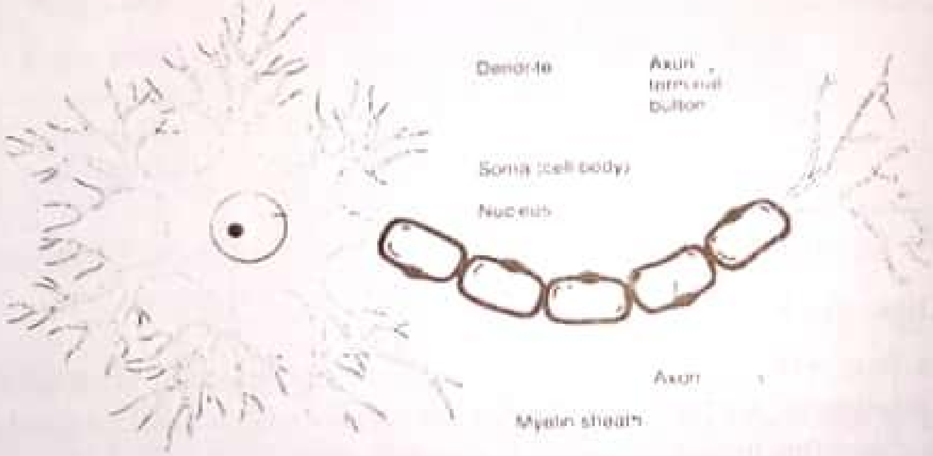


Fig: Human Sensory Neuron

MAJOR MUSCLES OF THE BODY

Sr. No.	Muscle	Common Name	Action of the Muscle
1.	Trapazius	Traps	Raises and lowers shoulder girdle; moves shoulder blades; moves head backwards and to the side.
2.	Sterno-cleido-mastoid	Neck	Bends head and neck to the side; rotates head and neck; draws head forward.
3.	**Forearm Group:** Brachioradialls, of Radialis Longus, Flexors and Extensors Radiatis Brevis, Carpi	Forearm	Bends and straightens the wrist; bends and straightens the fingers and thumb

[redacted]

	Ulnaris, Pollicis Longus and Brevis.		
4.	Brachialis anticus	Brachialis	Bends the forearm to the upper arm.
5.	Biceps	Biceps	Bends the forearm to the upper arm; turns the forearm.
6.	Triceps	Triceps	Straightens the arm and draws it backward.
7.	**Deltoid Group:** Anterior Head, Lateral Head, Posterior Head.	Delt	Raises arm to horizontal position; each head lifts arm in particular direction. Anterior (front), Lateral (side), Posterior (rear)
8.	Pectoralis Major	Pecs	Draws the arms inward, forward and downward, rotates the arm inward; assists in the expansion of the chest.
9.	Serratus Magnus	Serratus	Rotates the shoulder-blade downward; draws shoulder-blades apart; assists in the expansion of the chest.
10.	External Obliques	Obliques	Bends the spine forward and to the side.
11.	Rectus abdominus	Abs	Bends the spine forward and to the side.
12.	Latissimus Dorsi	Lats	Draws the arm downward and backward; depresses the shoulder girdle; assists in forced inhalation; bends the trunk sidewards.
13.	**Back Group:** Teres Major, Teres Minor, Rhombiodeus, Infraspinatus	Back	Rotates the arm inward and outward; assists in swinging arm backward; rotates, rises and draws the shoulder-blades together.
14.	Vastus Externus	Thigh	Straightens the leg.
15.	Rectus Femoris	Thigh	Straightens the leg; flexes the hip joint.
16.	Vastus Internus	Thigh	Straightens the leg.
17.	Sartorius	Thigh	Bends the leg; flexes the hip joint; rotates the leg inward and outward.
18.	Biceps Femoris	Thigh Biceps	Bends the leg; rotates the leg inward.
19.	Gastrocnemius	Calf	Extends the font, assists in flexing the knee.
20.	**Frontal Calf Group:** Soleus, Tibialis Anticus, Peroneus Longus.	Frontal Call	Extends, flexes and turns over the foot.

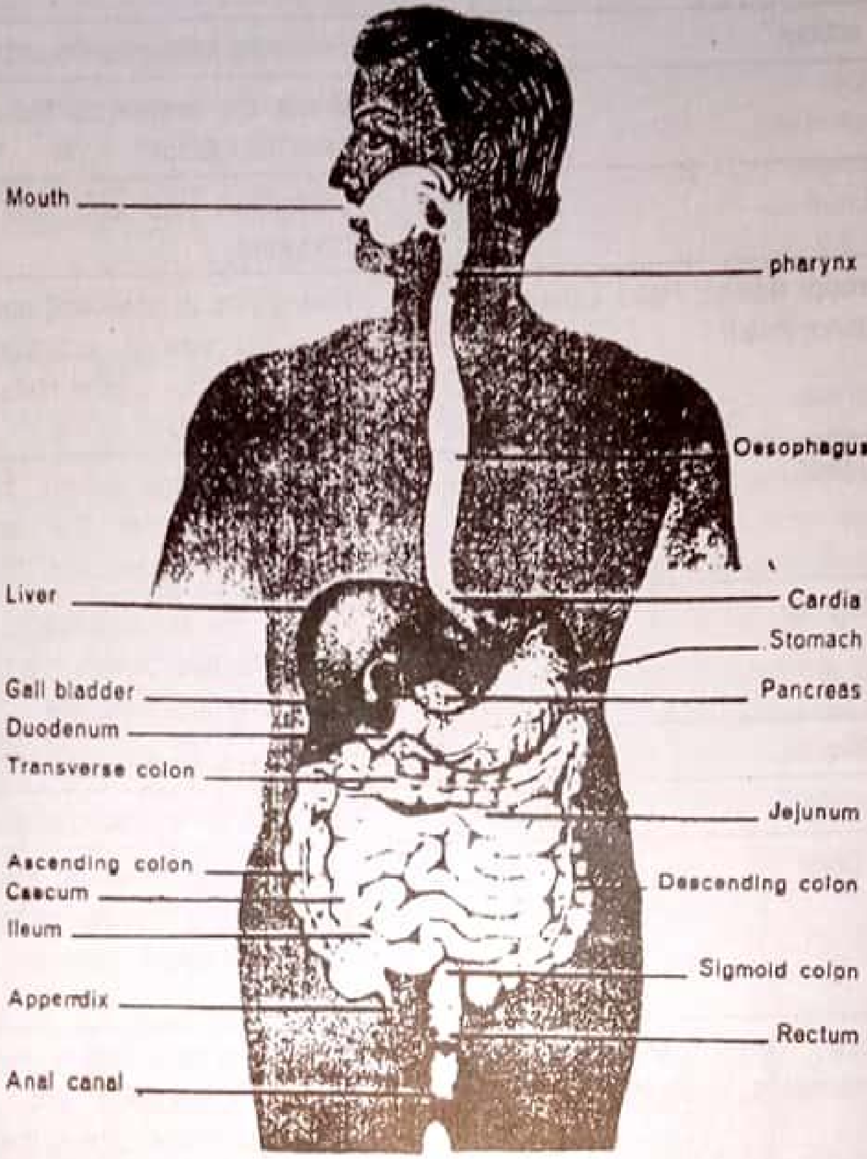
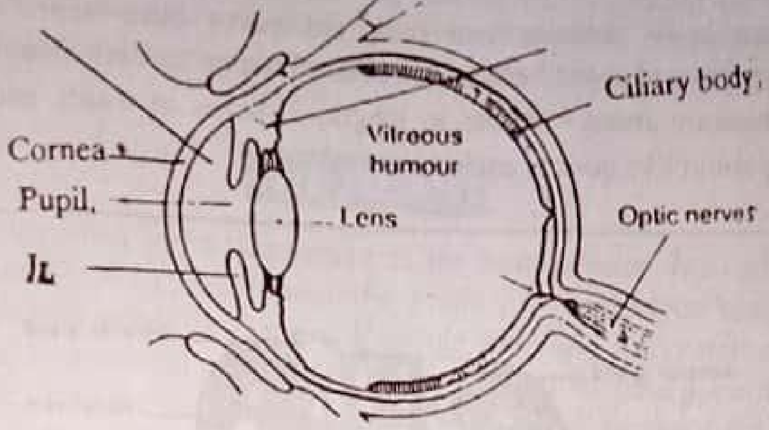


Fig: Digestive System

THE EYE

Introduction:

The organ of vision consists of the eyeball, which, with its muscles, blood-vessels, nerves, fatty tissue and other protecting structures, completely fills the orbit or eye-socket. In front the ball of the eye is protected by movable folds of the skin or integument called the eyelids. The upper eye-lid is larger and more movable than the lower one, and it is chiefly by the elevation and depression of this lid that the eye is opened and dosed. The eye ball is moved by six muscles. The front of the eye-ball is kept clear and moist by a saline fluid which is secreted continuously by lachrymal gland. The general form of the eye-ball is globular. The eye ball has three distinct coats. The external consists of the sclerotic coat and the cornea, the middle coat is formed by the choroids' membrane and the iris; the inner is termed as Retina. The essential parts of the eye are explained below.



The Eye

The Cornea:

The cornea is a highly transparent tissue and is continuous with the sclerotic coat covering the front of the eyeball. It is not supplied with blood-vessels but is well-supplied with undifferentiated nerve endings.

The Iris:

The iris is the circular curtain, seen through the cornea, which gives the colour to the eye. The coloured ring is situated in the middle of each eye. It can be brown or blue. Its outer border is continuous with the choroids' coat which like the sclerotic, does not extend over the front of the ball.

The Pupil:

The iris diaphragm is perforated in its centre by a circular aperture which appears as a dark spot called the pupil. The diameter of the pupil can vary from 1/3rd to $^{1}/_{20th}$ of an inch, and the quantity of light admitted into the eye-ball is regulated.

The Lens:

It is the most important part of the eye and it is doubly convex body which contains neither vessels nor nerves and is situated close behind the iris. It is made of many concentric layers of fibrous cells, is approximately 65% water and 6% fat, and contains more proteins than any other tissue. The lens is held in place by an elastic capsule. The lens gets thinner when we look into the distance and fatter when we look at something close-up.

The Retina:

The retina is a delicate membrane, which lies within the choroids' coat. It consists of an expansion of the fibres of the optic nerve, supported by an extremely delicate connective tissue. The retina is made up of rods and cones which act as photoreceptors. Rods are the rod-shaped light receptors found mainly on the edge and sides of the retina. They are sensitive to low intensity and in dim light. Cones are the cone-shaped receptors situated mainly in the center of the retina, around the yellow spot. They are sensitive to different light colours. Sharpness, of the image is also associated with cones. There are about 140 million receptors, 95% rods and 5% cones There are about 120 million nerve cells in the retina.

THE KIDNEYS

The human body contains two dark red-brown bean-shaped organs called the Kidneys. These are situated at the back of the abdomen, one on each side of the upper lumber vertebrae. They measure about 4 inches in length, 2 inches in width, and 1½ in thickness, their weight being about 4½ ounces each.

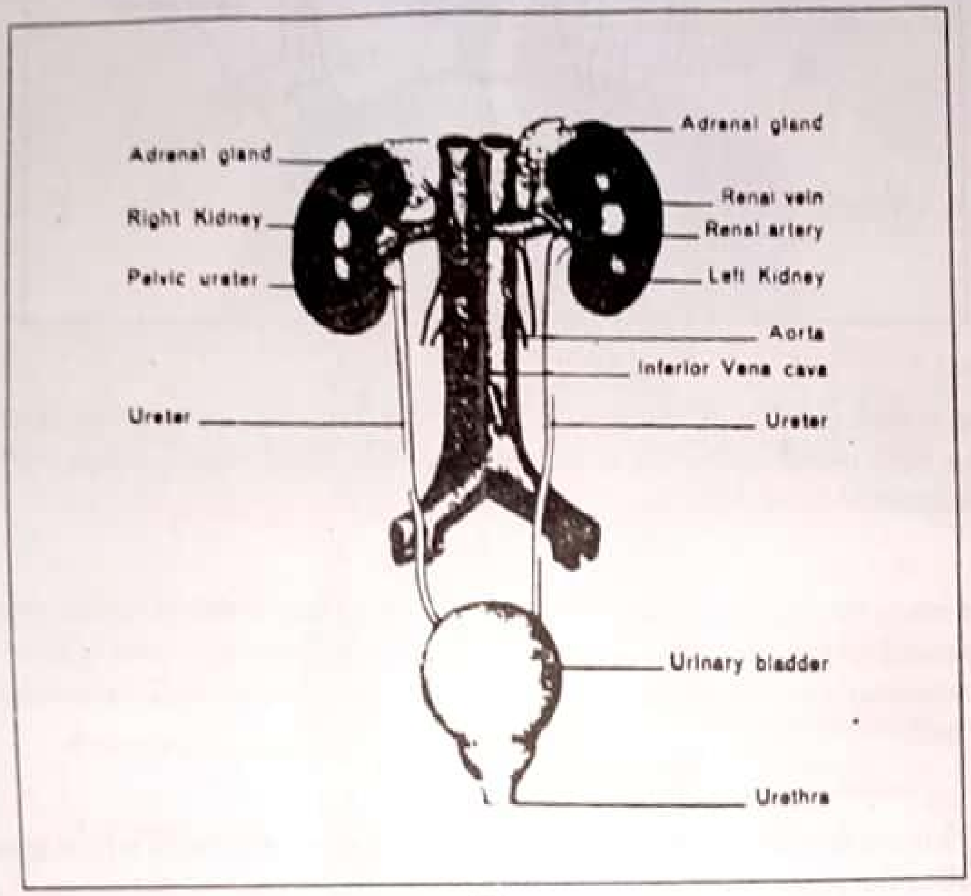


Fig.

The kidneys are arranged with their concave surfaces directed towards the vertebral column; and the right kidney which is usually shorter and thicker than the left, is generally a little lower, probably on account of the downward-extension of the large right lobe of the liver. The kidneys are supplied with blood by the renal arteries and the renal veins take blood away from them. Each kidney contains about one million nephrons, minute renal tubules each of which begins as a dilate spherical capsule into which a complicated loop of capillaries enters. The kidneys remove waste products like urea and uric acid from the blood and maintain the electrolytic balance. The kidneys are connected to the bladder through ureters.

THE LIVER

It is the largest gland of the body. It is located at the top of the abdomen. It consists of two parts called lobes, the right and the left. The right lobe is well-supplied with blood vessels and it removes a large quantity of the impurities from the blood which it has gathered from various parts of the body. The substance of the liver is made-up of small lobules, each about one — twentieth of an inch in diameter and is therefore distinctly visible to the naked Eye. The liver has hundreds of functions. Its most important function is the secretion of the bile which is continuous, but is retarded during fasting and increased on taking food. The liver also prepares glycogen, which resembles starch and sugar in composition. The liver has the power of arresting various poisonous substances which have found their way into the blood.

THE HEART

It is one of the most important organs of the human body. It is a hollow muscular organ and it forces the blood to pass through the whole system of blood vessels by its strong contractions. It is situated nearly in the middle of the front and lower part of the chest, just above the diaphragm. It is conical in shape and is placed with its base uppermost and with its apex downwards and towards the left. Its size is about equal to that of the closed fist. It weighs about nine ounces in an adult. The heart contains four cavities — the right and left Auricles and the right and left Ventricles through which the blood circulates. The great blood vessels of the heart are: (see the chart).

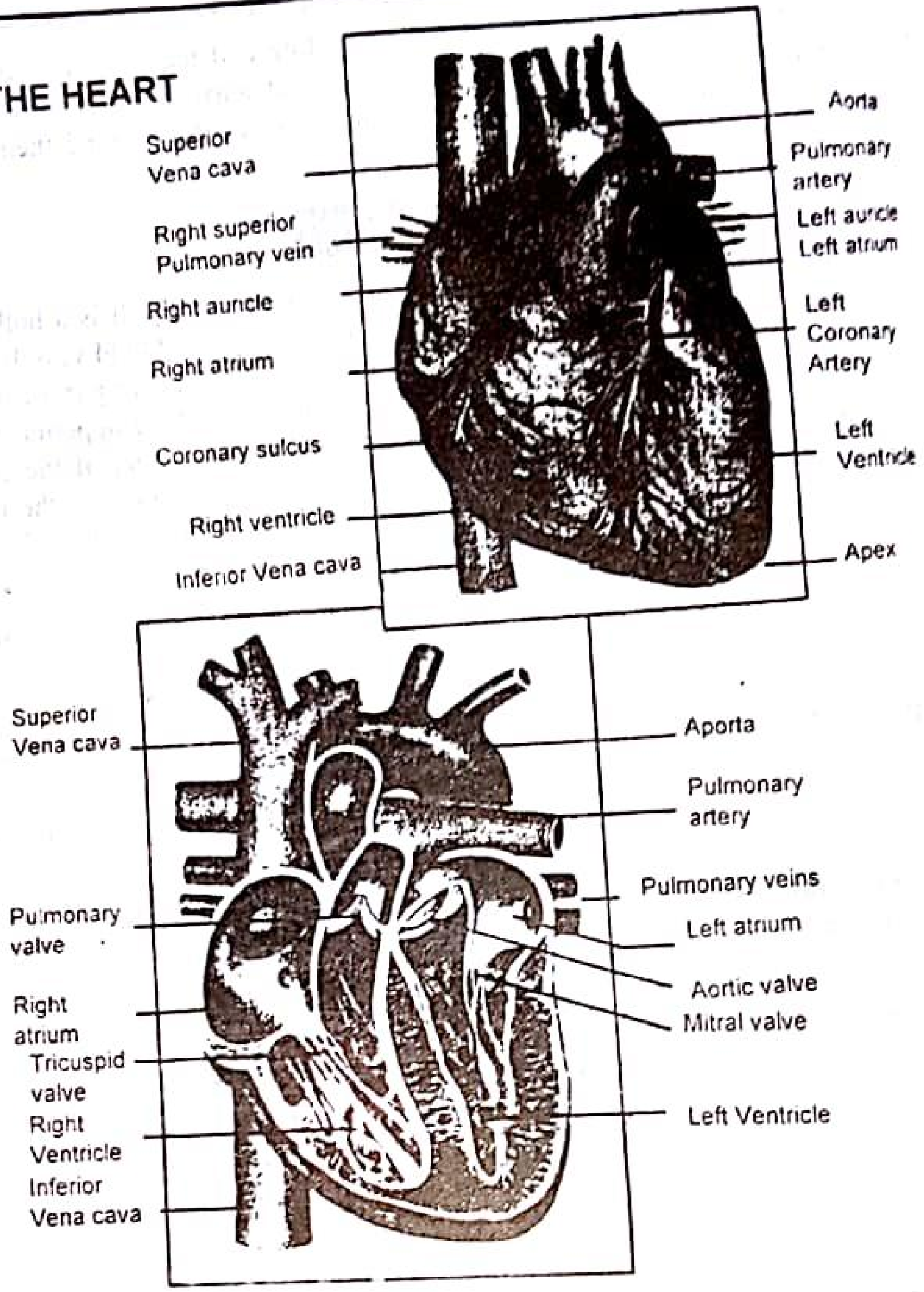
(i)	**Aorta:**	It is the largest artery leading direct from the left ventricle. It conveys blood from the left side of the heart to all parts of the body.
(ii)	**Pulmonary Arteries:**	These are two other arteries leading direct from the right ventricle, called the Right and Left Pulmonary Arteries. They convey blood from the right side of the heart to the lungs.
(iii)	**Inferior and Superior Vena Cava:**	These are two large veins, communicating with the right Auricle. They collect blood from all parts and carry it into the right cavity.
(iv)	**Pulmonary Veins:**	These are those two veins which communicate with the left auricle. They collect the blood which has circulated in the lungs, and convey it into the left cavity.

The Auricle and Ventricle of each side of the heart communicate with each other, so that the blood which has entered the auricle can pass into the corresponding Ventricle.

The heart muscles are the strongest in the human body and they have their own supply of blood in order to work, and this is provided by the coronary arteries, which branch off the Aorta.

Cardiac Veins return the used blood into the vena cava. Its specialized cardiac muscle is responsible for its continuous rhythmic contractions. The intrinsic heart rate is 100/minute.

THE HEART



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THE BLOOD

The blood is a vital fluid connective tissue. It consists of an alkaline fluid containing plasma, water, mineral salts, albumen and other nitrogeneous matter. The colour of the blood is due to the presence of a nitrogeneous substance, called haemoglobin in the red corpuscles. The blood corpuscles are of two types, the red and the white or colourless. The red corpuscles are minute circular discs, concave on both sides. They are so numerous in the blood that they make it a thick liquid. The white or colourless corpuscles are a little larger than the red. Being composed of a very soft, jelly-like substance (protoplasm) they readily change their form.

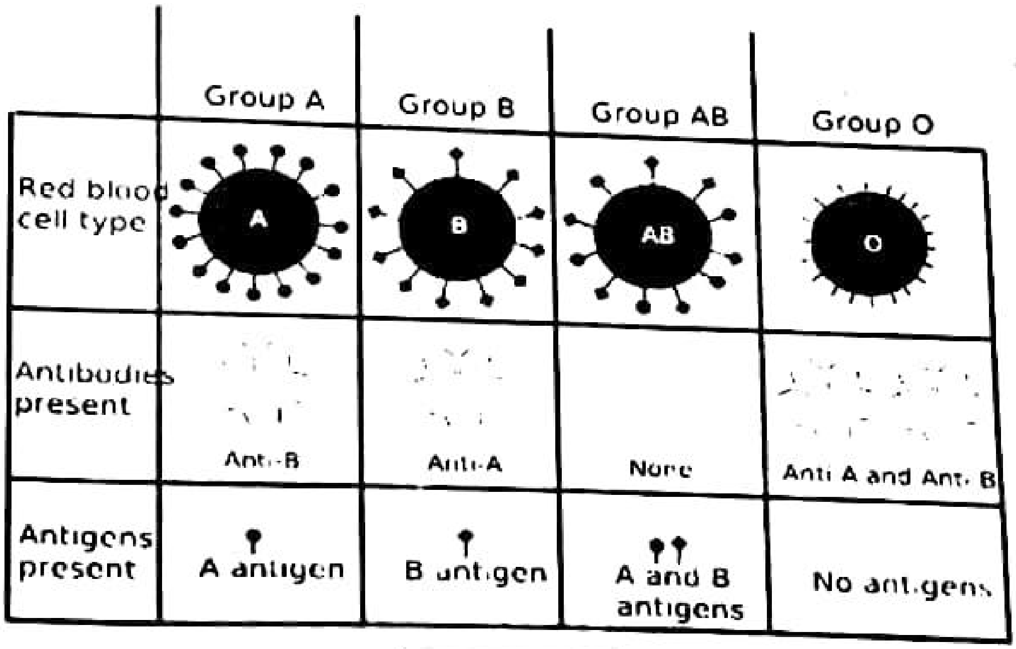
When freshly-drawn blood is allowed to remain at rest for a while, it becomes semi-solid and jelly like by the formation of what is called a clot. The clot is due to the formation of fibrin. The normal temperature of the blood is 98.4 °F in a healthy body. The quantity of blood in the human body varies with certain conditions, but it is usually estimated that it is about one-tenth of the total weight of the body and is about 5.5 litres in volume.

Some important functions of the blood in the human body can be summed up as follows:

(1)	It serves as a storehouse for nutrient matter absorbed from the foods, and conveys the nutrients to all parts of the body.
(2)	It transports the materials from which the secretions are formed to the various glands which prepare them.
(3)	It carries the oxygen gas to all the tissues when the process of oxidation occurs, and the heat released maintains the high temperature of the body. Red blood cells are the body's oxygen carriers. Red bloods cells are constantly being made in the body's bone marrow.
(4)	It collects up waste materials, and conveys them to the excretory organs for separation and removal.
(5)	It distributes the heat throughout the body.
(6)	It moistens the various tissues.

ABO System:

The **ABO blood group system** is the most important blood type system (or blood group system) in human blood transfusion. The associated anti-A antibodies and anti-B antibodies are usually IgM antibodies, which are usually produced in the first years of life by sensitization to environmental substances such as food, bacteria and viruses. ABO blood types are also present in some animals, for example apes such as chimpanzees, booboos, and gorillas.



	Group A	Group B	Group AB	Group O
Red blood cell type	A	B	AB	O
Antibodies present	Anti-B	Anti-A	None	Anti A and Anti B
Antigens present	A antigen	B antigen	A and B antigens	No antigens

THE SKIN

The skin forms a protective coating over the whole body and act as a mechanical barrier against the entry of bacteria. It consists of two layers, the Epidermis and the Dermis:

The Epidermis:

The epidermis, cuticle, or scarf-skin covers every part of the dermis or true skin. It is hard and horny, and composed of minute scales which are being continuously worn away from the surface. Its thickness varies in different parts. The surface of the epidermis contains small openings called the pores of the skin. They are actually the openings of the ducts of little glands which secrete the sweat or perspiration. The epidermis itself carries no blood-vessels but few nerves, its main functions being simply to protect the deeper layer of the skin.

The Dermis:

The dermis or true skin consists of fibres of connective and elastic tissues, interwoven with minute blood vessels and nerve fibres.

The deeper portion of the dermis is looser in texture, and contains an amount of fatty tissue.

Nails and hair are out-growths of the epidermis or cuticle, and both agree with it in general structure. A nail is simply a thick layer composed of the thin horny scales of the outer portion of the cuticle. Each hair consists of a root or bulb and a shaft or stem.

The main functions of the skin can be summed up as follows:

(1)	It provides protection against all sorts of infections.
(2)	It regulates the body temperature.
(3)	It acts as an excretory organ and removes waste materials from the blood.
(4)	It synthesizes vitamin D when exposed to sunlight.
(5)	It reflects the age of person.
(6)	It is a basic sense organ and it gives a feel of touch.
(7)	It gives shape and beauty to the human body.
(8)	It absorbs oil and some drugs from its surface.

THE TEETH

The permanent teeth of an adult number thirty two. They consist in each jaw, of four incisors, two canines, four bicuspid, and six molar. The last of the molars are called the wisdom teeth. Tooth is the hardest part of human body. Each tooth has a crown, a neck and a root consisting of one, or more fangs. The crown is the part which protrudes beyond the gum into the mouth. The neck is that slightly constructed portion which is embraced by the gum and the fang or fangs include all that part of the tooth which penetrates into the jawbone. The mass of a tooth consists mainly of a hard substance called dentine or ivory. It is similar in composition to the compact tissue of bone, but contains a much larger proportion of mineral matter and is consequently harder. The main use of the teeth is to masticate the food. The dentine which forms the crown of the tooth is covered with a substance called the enamel.

THE LUNGS

The lungs are spongy and elastic bags, comprising of air-tubes and cells, blood vessels and elastic tissue. They fill the cavity of the thorax with the exception of the space occupied by the heart, the great vessels, and the oesophagus, consequently their general form coincides with dark venous blood by means of the pulmonary arteries which proceed from the right ventricle. These arteries divide and subdivide into smaller and smaller branches, penetrating every portion of the organs, till at last they form capillary network which surround and lie on the walls of the air sacs. The walls of the air-sacs are extremely thin, as are also the wall of the capillary vessels, and thus the blood is brought almost in contact with the inspired air. It is in about 20 to 30 cubic inches of air passes in and out of the lungs in ordinary quite breathing.

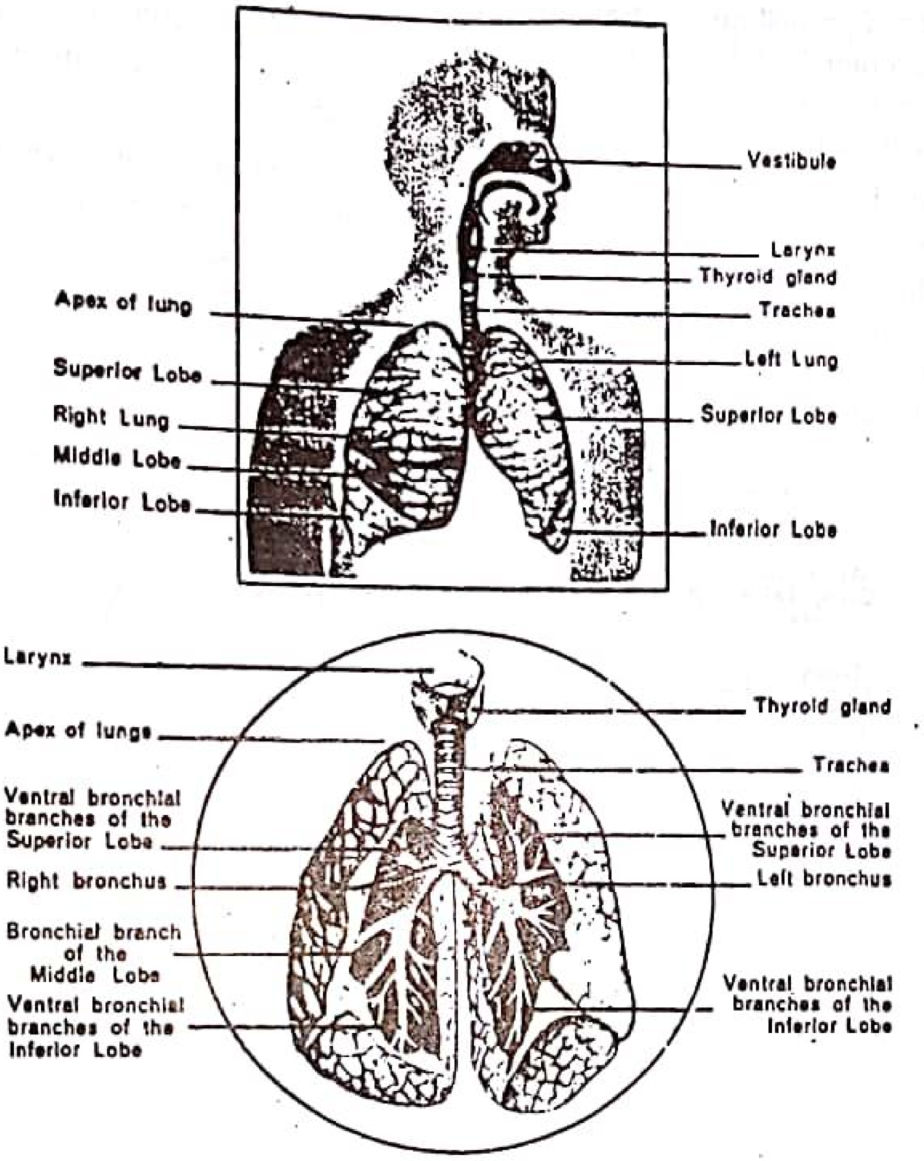

Vestibule
Larynx
Thyroid gland
Trachea
Left Lung
Superior Lobe
Inferior Lobe
Apex of lung
Superior Lobe
Right Lung
Middle Lobe
Inferior Lobe
Larynx
Thyroid gland
Apex of lungs
Trachea
Ventral bronchial branches of the Superior Lobe
Ventral bronchial branches of the Superior Lobe
Right bronchus
Left bronchus
Bronchial branch of the Middle Lobe
Ventral bronchial branches of the Inferior Lobe
Ventral bronchial branches of the Inferior Lobe

Fig.

THE BRAIN

It is the great nerve centre of the body and it is large upper portion of a cerebro-spinal axis filling the cavity of the cranium. It mainly consists of soft-nerve substance. The average weight of an adult human brain is about 3-pounds. The surface of brain is covered with a very thin and delicate membrane called the pia matter, which consists of a thickly meshed network of small arteries and veins supported by connective tissue. The brain consists of several parts, the main of which are:

(1) **The Cerebrum (Greater Brain):** It fills all the upper and frontal portion of the cranium, and weighs about nine-tenth as much as the entire brain. The cerebrum consists of two large hemispheres, the right and the left, separated by a very deep fissure. The cerebrum is the chief seat of sensation, intelligence, the will and the emotions.

(2) **The Cerebellum (Lesser Brain):** It lies underneath the back portion of the cerebrum. It also consists of two hemispheres, each composed of an external layer of grey matter surrounding white fibrous substance. Its main function appears to be the regulation or coordination of all muscular movements.

(3) **The Pons Varolii:** It is a broad band or bridge of nerve matter which connects the right and left portions of the cerebellum, passing round the medulla.

(4) **The Medulla Oblongata:** It connects the brain with the spinal cord; it governs those involuntary movements which constitute the acts of breathing and swallowing. From the under surface of the brain, twelve pairs of nerves are given off. These are called the cranial nerves.

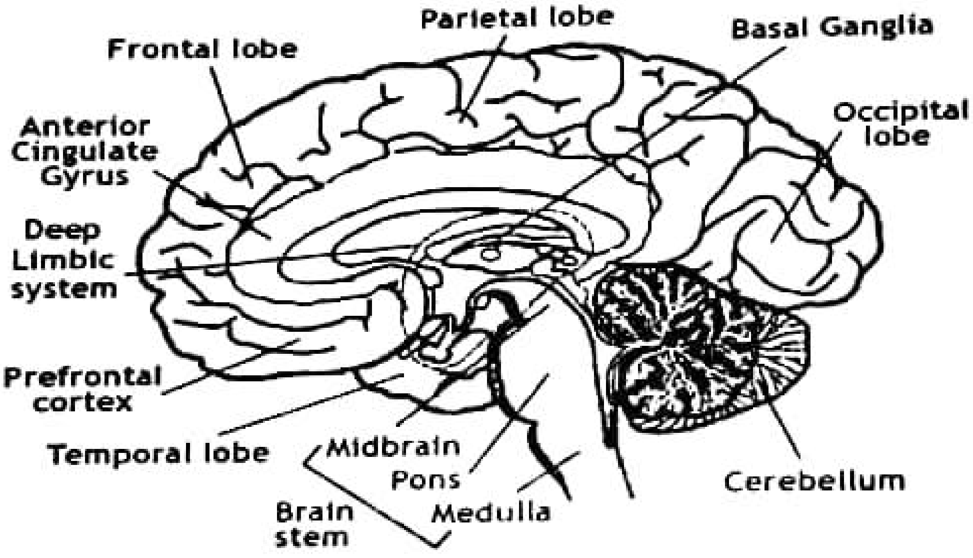


Fig: Human Brain

THE EAR

The ear is another important sensing organ. The ear consists of three important parts, mainly the External Ear, the Middle Ear and the Internal Ear. The Internal ear is the essential part of the organ of hearing while the other two parts are concerned merely in the collections and transmission of sound vibrations. The outer ear consists of the Pinna — it is that part which projects from the side of the head, and the auditory canal. The concave shape of the pinna is especially adapted for the collection of sound waves which are reflected by it into the canal. It consists of a cartilaginous framework, surrounded by a certain amount of fatty tissue and a few small muscles, the whole being covered with integument.

The middle ear is a small irregular cavity in the temporal bone. It is separated from the auditory canal by the tympanic membrane, and contains a chain of small bones by means of which the vibrations received by the drum are transmitted across the cavity to the inner ear. The internal ear consists of very complex cavity hallowed out of the bone, which contains a similar cavity bounded by the membranous walls. The bone of the internal ear consists of three parts; the vestibule, the semicircular canals and the cochlea.

EXERCISE

Q. Differentiate clearly between Carnivores, Herbivores, Omnivores and Predators with examples?

Ans. **Carnivores:** These are those animals which eat meat. Typical examples are lions, dogs, cats — the shape of their teeth is ideal for the way they feed. Carnivores' jaws can only move up and down. Their teeth sheer meat with a scissors-like action.

Herbivores: These are those animals which eat plants. Typical examples are sheep. cows and goats-the shape of their teeth is ideal for cutting and chewing grass and other vegetables. Herbivore's jaws can move sideways which helps the grinding of the food.

Omnivores: These are those animals which can eat any kind of food. Their teeth are suitable for eating both meat and plants. Man is a typical example.

Predators: These are those animals that live by preying upon other animal species. Tiger is a typical example.

Q. Name the hardest substance in the human body?

Ans. Enamel is the hardest substance in the human body. Flouride toothpaste helps to prevent tooth decay; Fluoride hardens the enamel.

Q. Give the names of the teeth in each human jaw?

Ans. Incisors, canines, Pre-molars and Molars.

Q. Name the types of cell division?

Ans. Basically there are two types of cell divisions namely Mitosis and Meiosis.

Q. Compare clearly Mitosis with meiosis in a tabular form?

Feature	Mitosis	Meiosis
Definition	Mitosis is the method by which body cells duplicate themselves for maintenance and growth of various tissues.	Meiosis is the method which involves two successive divisions.
Site	Somatic Cells	Germ Cells
Number of Divisions involved	Single	Two divisions
Chromosomal Number	Remains same	Reduced to half
Extra Chromosomal behaviour	Independent of each other	Homologous get paired together
Result	2 Cells	4 Cells

Q. What is a Cell Cycle?

Ans. It consists of sequence of events which keep repeating in relation to cell multiplicative activity, with the final event ending at the beginning of the first event of the net cycle.

Q. What is Pollination?

Ans. It is the phenomenon of transfer of pollens from male reproductive organ to female reproductive organ in flowering plants usually through biological agency or physical means. Reproduction in flowering plants is chiefly sexual. It involves the union, or fusion of the male and female reproductive cells. This is made possible by the transfer of pollens from the anther to the stigma.

Q. How do we sweat?

Ans. The cooling system of human body is regulated by a part of the brain called the Hypothalamus which acts as a sort of thermostat. When the body gets hot, the hypothalamus activates the sweat glands to produce a watery fluid-sweat. The liquid is released from the body through gland ducts. On evaporation, it provides a cooling effect. As much as a gallon of sweat can be lost under the hottest of circumstances.

Q. What are Exocrine Glands? Give Examples?

Ans. These are those glands which discharge their secretions by means of a duct. These are also called as ducted glands. Typical examples of Exocrine glands are given below alongwith their secretions.

Exocrine Glands	Secretions
Lachrymal	Tears
Sweat	Sweat
Salivary	Saliva
Mammary	Milk
Liver	Bite
Sebaceous	Sebum

Q. What are Ducts?

Ans. Ducts are small tubes, which transfer the secretion of glands.

Q. Differentiate clearly between Epidemic, Endemic, Acute, Chronic, Malignant and Innate disease?

Ans. Epidemic: Where there is a terrible outbreak of a disease affecting great number at one time and one place and are capable of travelling from one place to another.

Endemic. The disease is said to be endemic which is more or less constantly present in a population or an area.

Acute: Acute disease usually begins abruptly and is soon over.

Chronic: A chronic disease begins slowly and persists over a longer time.

Malignant: The term malignant is used to describe tumors.

Innate: An innate disease is a non-communicable disease.

Q. **Describe the following diseases:**

Goiter, Leprosy, Schizophrenia, Alzheimer, Addison, Multiple Sclerosis, Juvenile Diabetes and Haemophilia?

Ans. **Goiter:** It is a disease in which the enlargement of the thyroid gland takes place, causing a marked swelling in front of the neck, which sometimes results in pressure on the trachea. The cause may be the inability to utilize iodine.

Leprosy: It is a disease caused by bacterium. Transmission is through prolonged or close contact. Characteristics are thickening of skin and nerves, numbness deformity and disfigurement. It is controlled with sulphone drugs.

Schizophrenia: It is a disease of the abnormalities of devastating brain disorder. Symptoms are poverty of speech.

Addison: It is caused by immune proteins called antibodies, attacking the adrenal glands, resulting in hormone imbalances that lead to darkening of the skin, abdominal pain and sometimes coma.

Multiple Sclerosis: It results from immune cells damaging the central nervous system causing tingling, blindness and paralysis.

Juvenile Diabetes: It occurs when immune cells destroy cells of the pancreas, leading to an inability to produce insulin — the hormone that helps the body to use glucose. Weight loss, kidney failure and blindness can result due to this disease.

Haemophilia: It is a disease in which the persons have prolonged blood clotting time resulting in excessive bleeding from injury. It occurs due to the deficiency of Vitamin K which carries blood-clotting properties. Normal clotting time is 5 to 8 minutes.

Q. **Name some more common diseases of the eye?**

Ans. Myopia, Hypermetropia, Glaucoma, Cataract and Pressbyopia.

Q. **What is Incubation Period?**

Ans. A disease causing organism always requires some period after reacting healthy person to show the symptoms of the disease. This period is called incubation period.

Q. **Name some Viral Diseases?**

Ans. Measles, Mumps, Poliomyelitis, Rabies and Hepatitis.

Q. **Give one example of each: Airborne, Water-born, Skin-horn and Blood-horn diseases?**

INFECTION THROUGH	DISEASES
Air-born	Whooping cough, TB
Water-horn	Cholera, Jaundice
Skin-born	Malaria, Filaria
Blood-born	AIDS

Q. **Define Obesity?**

Ans. Obesity is basically an excess of disposed tissue in which fat is stored. It is made of predominantly fat cells.

Q. Name some Immune Warriors?

Ans. These are those cells of the immune system which fight against pathogens. These are macrophages, Helper T cells, Antibodies, B cells, MHC, antigens and memory cells.

Q. What are Allergies?

Ans. Allergies strike when the immune system overreacts to ordinarily harmless substances like dust or the droplet of toxin in a bee sting, causing inflammation.

Q. What is DTP Immunization?

Ans. It is a Vaccination against Diphtheria, Tetanus and Pertussis.

Q. What are Antiseptics? Give some examples?

Ans. Antiseptics are compounds that are applied to living tissues to kill or prevent the growth of micro-organisms. Many common antiseptics are mild oxidising agents like Hydrogen peroxide and potassium permanganate.

Q. Name the important organs involved in the digestion of food?

Ans. Mouth, Gullet, Stomach, Small Intestine and Large intestine. An adult's digestive system is about 10 meters long.

Q. Which spends more time in the stomach during digestion: Carbohydrates or Fats?

Ans. Carbohydrates spend the shortest time in the stomach, Fats spend the longest.

Q. What is the importance of Enzymes in digestion?

Ans. Enzymes are biological catalysts which have many functions in the human body. Digestive juices contain enzymes which attack the starch chain and split it. Pepsin, trypsin and ptyalin are typical examples. Enzymes have very specific jobs to do and have enormous catalytic power.

Q. What is Chymification?

Ans. Chyme is a milky fluid. The changing of the food into chyme by the gastric fluid is called chymification.

Q. What is meant by Addiction?

Ans. Addiction means that someone is so dependent on a drug that serious harm is being done to the person and society.

Q. What are Opiates?

Ans. Opiates are drugs made from the opium poppy. Opium is the dried milk of the poppy. Plant opiates and man-made opiates are sometimes collectively called as opioids. Opiates are used as pain-killers.

Q. Differentiate clearly between Tolerance and Dependence?

Ans. These terms are common in drug use. Tolerance means the way the body gets used to some kinds of drugs. Therefore, to get the same effect, the body needs an increasing amount of the drug.

Dependence means a desire for a drug as a result of taking it repeatedly.

Q. Differentiate clearly between cocaine, LSD and Amphetamine?

Ans. **Cocaine**: It is a white powder made from the leaves of the Andean Coca shrub. It is a powerful stimulant. It can be sniffed, smoked or injected. It produces a feeling of excitement and mental exhilaration.

LSD: Lysergic Acid Diethylamide (LSD) is a man-made white powder. It produces dizziness, disorientation and sometimes panic.

Amphetamine: It is a synthetic drug which stimulates the higher nerve centers, so increasing mental alertness and abolishing fatigue. It is a controlled drug and may give rise to addiction.

Q. What are the main functions of blood in a human body?

Ans. The main functions of blood in the human body are described below:

(i) It acts as a carrier of oxygen.

(ii) It acts as carrier of metabolic wastes of the body to kidneys, lungs, skin and intestine for removal.

(iii) It maintains the acid-base balance.

(iv) It helps in maintaining the body temperature.

(V) It transports food material to the tissues.

(vi) It regulates water balance.

Q. What is the Composition of Blood?

Ans. It consists of two fractions namely: Cellular and plasma fractions. The cellular fraction contains Erythrocytes, Leucocytes and Platelets.

Q. Differentiate between Plasma and Serum of Blood?

Ans. When blood is centrifuged, it splits up into two parts, a clear supernatant liquid called serum and a thick solid red part is called plasma. Serum differs from plasma, because it doesn't contain fibrinogen.

Q. What is Heme?

Ans. Heme is Ferrous Protoporphyrin.

Q. What is the normal life span of RBC's?

Ans. RBC's are red blood cells and their normal life span is about 120 days.

Q. What is Anemia?

Ans. Anemia is a clinical condition, which occurs due to subnormal (Hb) and number of RBC's in the body. Iron deficiency is usually responsible for this.

Q. What is the normal total blood volume in an adult?

Ans. It is about 5.5 litres.

Q. What is the pH of Blood?

Ans. It is 7.3-7.4, which remains fairly constant at this level.

Q. Define Lymph and give the functions of the Lymphatic System?

Ans. It is blood without blood corpuscles, a colourless fluid produced by lymph nods and concerned with body defence mechanism. Lymph is modified tissue fluid which is carried by Lymphatic vessels. It is a secondary transportation system. The lymphatic system also plays a role in the transportation of materials from one part of the body to another. It seems to return components of the interstitial fluid to the bloodstream. The lymphatic system is composed of veins and capillaries but no arteries. Lymph capillaries are closed at one end. Lymph flow is quite slow as compared to blood circulation.

Q. **What are the main phases of Cardiac Cycle?**

Ans. These are auricular systole, ventricular and general diastole.

Q. **Describe the following terms used in biological sciences: Immunity, Coma, Transfusion and Adaptation?**

Ans. **Immunity**: The resisting power of the body to the toxins of the invading bacteria, shown by the presence in the blood of neutralising antioxins.

Coma: It is a state of complete unconsciousness, in which all reflexes are absent.

Transfusion: The introduction of whole blood or plasma into a vein, performed in cases of severe loss of blood, shock or septicemia. It is used to supply actual volume of blood or to introduce constituents, as clotting factors, or antibodies, which are deficient in the patient.

Adaptation: The ability to overcome difficulties and adjust oneself to changing circumstances. Neuroses and psychoses are often associated with failures of adaptation.

Q. **Define the following: Cyst, Histamine, and Codeine?**

Ans. **Cyst**: It is a tumor with membranous capsule and containing fluid.

Histamine: It is an enzyme that causes local vasodilatation and increased permeability of the blood vessel walls.

Codeine: It is an alkaloid of opium said to be less depressed to the respiratory centre than other forms and is good for the treatment of persistent cough and bronchitis. It is analgesic and hypnotic.

Q. **What are the functions of the Liver?**

Ans. Liver is the largest organ in the human body and it has many functions. The most important are:

(i) It produces blood clotting factors.

(ii) It has powerful recuperative powers.

(iii) It repairs and regenerates itself up to a point and can carry on its operations when only 20 percent of its functioning ability remains.

(iv) It produces cholesterol.

Q. **Name different types of Dietary Fibers?**

Ans. There are five types of fibers that our body can use namely — Cellulose, Hemicellulose, Lignin, Pectin and Gums.

Q. **Why is ASPIRIN more recently called as the Wonder Drug?**

Ans. Because it can do the following:

(i) It reduces fever by interfering with temperature-elevating substance in the Hypothalamus.

(ii) It quells aches and inflammation.

(iii) It prevents heart attack.

(iv) It reduces the risk of certain type of strokes.

(v) It treats heart attack.

Q. Describe Acne, Insomnia and Appendicitis?

Ans. **Acne**: It is biological term denoting an inflammatory condition of the sebaceous glands.

Insomnia: It is an inability to sleep.

Appendicitis: It is an inflammation of the appendix Vermiformisit which is a Worm-like tube with a blind end.

Q. Describe very briefly the Nitrogen Cycle.

Ans. Nitrogen cycle is the continuous circulation of elemental nitrogen and its compounds in the ecosystem by living organisms. It is also called Fixation of Nitrogen or Natural Fixation. Industrial fixation is done to manufacture nitrogen fertilizers.

Q. Differentiate between Harmful and Helpful Bacteria?

Ans. Harmful bacteria are disease-causing bacteria and are called pathogens. Helpful bacteria do not cause disease but instead these are useful for health, for example, streptococcus lactis produces the acid that allows milk curds to settle into butter milk and many cheeses. Yogurt is made from skimmed milk and bacterial cultures. Bacteria can also be used for the preservation of food.

Q. Differentiate between Blood Pressure and Pulse Pressure?

Ans. Blood Pressure: It is a lateral pressure exerted by blood on the vessels walls during its flow.

Pulse Pressure: Pulse pressure is the difference between Systolic and Diastolic pressure.

Q. What is the Normal Heart Rate?

Ans. It is 72 minutes.

Q. Define ECG?

Ans. Electrocardiogram (ECG) is a record of tracings obtained by electrocardiograph during period of cardiac circle.

Q. What is the function of Kidneys in your body?

Ans. Kidneys control the amount of water in our body. They act as filters and contain about 2500,000 tiny filters which help to clean the blood.

Q. What is a Body Muscle? Name some important muscles of the body?

Ans. A muscle is made up of thousands of muscle cells arranged in bundles. Muscles move bones. There are about 600 muscles in the human body. Some more common muscles are Biceps and Triceps. If all the muscles in the body were able to pull in the same direction at the same time, they could lift 25 tonnes.

Q. Give some examples of Polysaccharides?

Ans. Glycogen, starch, dextrin and cellulose.

Q. **Differentiate clearly between Hypoglycemia, Hyperglycemia and Glycosuria?**

Ans. **Hypoglycemia:** A clinical condition in which blood sugar level is below normal.

Hyperglycemia: A clinical condition, in which blood sugar level is above normal.

Glycosuria: A clinical condition in which there is presence of glucose in urine.

Q. **What are the main functions of that large intestine?**

Ans.
- *(i)* Storage of farces and their evacuation.
- *(ii)* Absorption of water but not of foodstuff to any significant extent.
- *(iii)* Excretion of phosphate but not of iron or calcium.

Q. **Define Proteins? How are these classified?**

Ans. Proteins are nitrogen containing substances of high molecular weight formed by a number of amino acids united by a peptide linkage. These are classified into simple, conjugated and derived.

Q. **What is a cell membrane composed of?**

Ans. A cell membrane is composed of protein and lipid molecules forming a semi-permeable membrane, which is actively selective in its functions.

Q. **What is Golgi apparatus (complex) concerned with?**

Ans. The Golgi apparatus is concerned with secretory processes.

Q. **What is the number of chromosomes in somatic cells of human being?**

Ans. There are 46 number of chromosomes i.e., 22 pairs of somatic chromosomes and one pair of sex chromosomes.

Q. **What is the difference between mitotic and meiotic cell division?**

Ans. In miotitic cell division the number of chromosomes remains the same, whereas in meiotic cell division the number of chromosomes are halved.

Q. **What is DNA composed of?**

Ans. DNA has phosphoric acid (deoxyribose) and four nitrogenous bases i.e. two purine (adenine and guanine) and two pyramidines (thymine and cystosine).

Q. **Define homeostasis.**

Ans. Homeostasis is a process of maintaining constant normal conditions in the internal environment of the body to enable its optimum normal functioning.

Q. **Define muscle?**

Ans. Muscle is a contractile tissue, with a chemically stored energy, which can be transformed into mechanical one.

Q. **How many types of muscles are there in human body?**

Ans. There are three types of muscles viz, striated (voluntary), unstriated (involuntary or smooth), and cardiac muscle.

Q. **Define refractory period.**

Ans. It is a short period of ineffecitivity (between two successive stimuli) of second stimulus applied at a very short interval after the first stimulus.

Q. **How is muscle contraction initiated?**

Ans. It is initiated by ATP dissociation.

Q. **What is electromyography?**

Ans. It records the muscle changes in form of tracings with the help of electromyography. It is helpful to diagnose neuromuscular disorders like myasthenia gravis, myotonias etc.

Q. **What is the effect of muscular exercise on blood flow?**

Ans. The blood flow through the muscles increases from resting level of 2 ml/100 gm. To 25-30 ml./100 gm. per minute.

Q. **What do you mean by muscle cramps?**

Ans. Muscular cramps are involuntary, localized painful contractions of muscles often relieved by stretching the affected muscles.

Q. **What is the source of energy in a plain muscle?**

Ans. These are fatty acids, acetoacetic acid and to a lesser extent glucose.

Q. **What is nervous impulse?**

Ans. Nervous impulse is typical change (state of negativity by depolarization) at point of stimulation of nerve fibre and its propagation throughout its length with definite velocity.

Q. **What is blood?**

Ans. Blood is vital fluid connective tissue (mesodermal in origin) in the body consisting of Plasma and formed elements i.e. RBC's WBC's and platelets.

Q. **What is the difference between plasma and serum?**

Ans. Plasma is fluid portion of the blood obtained without clotting while serum is the fluid obtained after clotting. Serum is thus plasma minus fibrin.

Q. **What is the most important function of blood?**

Ans. The most important function of the blood is transport of oxygen and nutrients (also hormones, antibodies etc.) to all parts of the body and carriage of CO_2 and waste products to the excretory organs.

Q. **What is normal RBCs count?**

Ans. It is 4.5 to 5 million per c.mm.

Q. **Which is the principal cation in the RBCs?**

Ans. It is potassium.

Q. **What is the normal life span of RBCs?**

Ans. It is about 120 days.

Q. **What is normal Hb?**

Ans. It is 14.5 to 15 gm%.

Q. **What is the shape of haemoglobin crystals in human blood?**

Ans. These are rhombic in shape.

Q. **What is the number of iron atoms contained in each molecule of Hb?**

Ans. There are four iron atoms in each molecule of Hb.

Q. **What do you understand by anaemia?**

Ans. Anaemia is a clinical condition, which occurs due to subnormal amount of Hb, and number of RBC is the body.

Q. **What is polyethemia?**
Ans. Polyethemia is a condition, in which the number of RBCs in the body is above normal.

Q. **What is leukaemia?**
Ans. Leukaemia is a morbid condition resulting in malignant growth of leucocytes with qualitative and quantitative changes in WBCs circulating in the blood.

Q. **What are the blood platelets?**
Ans. These are one of the formed elements of blood; being tiny cytoplasmic structures with granules but no nucleus and are derived from megakaryocytes.

Q. **What is the normal platelet count?**
Ans. It is 2.5 to 5 lacs per c.mm.

Q. **What is the normal life span of blood platelets?**
Ans. It is approximately 5-11 days.

Q. **What do you understand by ESR?**
Ans. ESR (erythrocytic sedimentation rate) is the rate of setting of red cells in a special graduated tube (Westergren or Wintrobe) fixed vertically in a stand. It is read at the end of half an hour, one hour and two hours. ESR is dependant on relative concertration of fibrinogen and globulin in plasma.

Q. **What is relative usefulness of ESR. Is it prognosis or diagnosis of the disease?**
Ans. ESR is useful in prognosis of the disease rather than its diagnosis?

Q. **What are the main conditions in which blood viscosity rises?**
Ans. These are acidosis, hypercalcaemia and hyperglycaemia.

Q. **What is the normal total blood volume?**
Ans. It is 5.5 litres.

Q. **Name the main buffer systems in the body which help to maintain the body pH?**
Ans. The main buffer systems to maintain the pH of the body are bicarbonate buffer system, phosphate buffer system, protein buffer system and hemoglobin buffer system.

Q. **Explain briefly the process of coagulation blood?**
Ans. Coagulation is the process of clotting of blood in which plasma takes active part. While the cells are physically caught in meshes of insoluble fibrin threads, which are formed by action of thrombin on soluble fibrinogen; thrombin being formed from prothrombin by action of calcium and activated thrombolastin which is due to tissue damage (extrinsic) or platelets disintegration (intrinsic).

Q. **What is normal clotting time?**
Ans. Is it 5 to 8 minutes.

Q. **Why blood does not clot in the blood vessels?**
Ans. It is due to constant flow of blood, somoothness of vessel linings, presence of natural inhibitors of coagulation (anticephalin and heparin).

Q. **What is haeomophilia?**

Ans. Haemophilia is inherited sexlinked anomally transmited by females to males, in which females do not suffer, while males are affected, so that they have prolonged clotting time resulting in excessive bleeding from injury etc.

Q. **Name the anticoagulant normally present and secreted in the body?**

Ans. It is heparin.

Q. **Name some of the important blood groups.**

Ans. These are 'ABO', 'MN', 'Rh', P and Lewis blood groups.

Q. **How are the blood groups under 'ABO' type classified?**

Ans. These are 'A', 'B', 'AB', and 'O' blood groups.

Q. **What is the characteristic in structure of cardiac muscle, which enables its continuous rhythmic contractions?**

Ans. Cardiac muscle its free branchings between the muscle fibres forms a sort of syncytium; moreover it has special conduction tissue. These two factors ensure its continuous rhythmic contractions.

Q. **What is "Pace maker of the heart"?**

Ans. It is another name for S.A. node. Since the S.A. node initiates the heart beat, it is called 'Pace make for the heart'.

Q. **What is law of heart muscle?**

Ans. Law of heart muscle states that the size of fibres, glycogen content and rate of conduction increase from nodal to Purkinje while length of systole, duration of refractory period and rhythmicity increase in the reverse order.

Q. **What are the main phases of cardiac cycle?**

Ans. These are auricular systole, ventricular and general diastole.

Q. **What is the normal duration of cardiac cycle?**

Ans. With heart beat rate of 75/min, each cardiac cycle lasts for 0.8 seconds, i.e.

Auricular systole : 0.1 sec.
Ventricular systole : 0.3 sec.
General diastole: 0.4 sec.

Total : 0.8 sec.

Q. **What is cardiac index?**

Ans. Cardiac index is minute volume per sq. meter of body surface area (3.8 litre/sq. meter of body surface area).

Q. **Define Electrocardiogram (ECG).**

Ans. ECG is a record of tracings obtained by electrocardiograph during different periods of cardiac cycle.

Q. **What is effects of nicotine on heart?**

Ans. Dilute nicotine solutions stimulate the vagal action and strong solution depresses this action by paralyzing the ganglion cells.

Q. **What is action of atropine on heart?**

Ans. Atropine paralyses parasympathetic fibres at their termination, and also neutralizes the effect of pilocarpine and acetylcholine.

Q. **What is normal heart rate?**

Ans. It is 72/min.

Q. **Enumerate some of the factors, which affect the heart rate?**

Ans. Some of these are impulses from higher centres, respiration, reflexes from S.A. node, great veins, changes in oxygen and carbon dioxide concentration of the blood, variation in body temperature and muscular exercise.

Q. **What is blood pressure?**

Ans. It is a lateral pressure exerted by blood on the vessel walls during its flow.

Q. **What is systolic pressure?**

Ans. Systolic pressure is the maximum pressure recorded during systole and indicates the maximum work of the heart.

Q. **What is diastolic pressure?**

Ans. Diastolic pressure is the minimum pressure recorded during diastole and indicates the resistance which the heart has to overcome while the aortic valves are open.

Q. **What is pulse pressure?**

Ans. Pulse pressure is the difference between systolic pressure and diastolic pressure.

Q. **What are the normal values of systolic, diastolic and pulse pressure?**

Ans. Systolic pressure is normally 120-125 mm Hg, diastolic pressure is 80 mm Hg, while the pulse pressure is 40 mm Hg. The ratio between is roughly 3:2:1.

Q. **What do you understand by pulse?**

Ans. Pulse is a wave transmitted by increased pressure which passes along the arteries during each heart beat. Velocity of pulse tends to increase with age.

Q. **Define haemorrhage.**

Ans. Haemorrhage is the condition, in which blood flows out of the vessels due to their rupture owing to any cause. It may be external or internal.

Q. **What is haemostasis?**

Ans. Haemostasis is the process of prevention of blood loss through the blood vessels when injured.

Q. **What is respiration?**

Ans. It is 16-18 per minutes in adults, being more in children.

Q. **What is total lung capacity?**

Ans. It is the amount of air in the lungs after maximum deep inspiration. It is equal to sum of vital capacity and residual volume (5.5 litres).

Q. **What is composition of expired air?**

Ans. It has 16.4% oxygen, 4.1% CO_2 and 79.5% nitrogen.

Q. **What is composition of alveolar air?**

Ans. It has 13.8% oxygen, 5.5 CO_2 and 80.7% nitrogen.

Q. **What is anoxaemia?**

Ans. It is decreased amount of oxygen in blood.

Q. **What is anoxia?**

Ans. It is lack of oxygen supply to the tissues.

Q. **Name of salivary glands.**

Ans. Three pairs of salivary glands are submandibular (submaxillary), parotid and sublingual salivary glands.

Q. **What are the main secretions of pancreas?**

Ans. The pancreatic cells in the pancreas secrete pancreatic juice, while β cells of islets of Langerhans secrete insulin and the α-cells secrete glucagons.

Q. **What are the digestive enzymes present in the pancreatic juice?**

Ans. These are trypsinogen, chymotrypsinogen, amylase (amylopsin), and lipase (stypsin).

Q. **What is the action of maltase?**

Ans. Maltase converts maltose into two molecules of glucose.

Q. **What is the action of lactase?**

Ans. Lactase converts lactose into glucose and galactose.

Q. **What is the normal dally secretion of bile juice?**

Ans. It is approximately 0.5-1 litre.

Q. **Name the various movements in the alimentary tract?**

Ans. These are mastication, deglutition, gastric movement (rhythmic and tonic contractions, perstalsis, and hunger contractions), movements in small intestine (segmentation peristalsis antiperistalsis and pendular movements), villous movements, movements is large intestines (peristalsis, and mass perstalsis), and the act of defacecation.

Q. **What are the various stages in the process of starch digestion?**

Ans. The salivary and pancreatic amylases act on polysachharides toe conver them into disachharides (maltose). The disachharides maltose, sucrose, and lactose and acted upon by maltase, sucrase and lactase respectively in succus entericus to be converted into monosachharides.

Q. **How is fat digested?**

Ans. Fats with the action of lipase are converted into glycerol and fatty acids, which are absorbed as such.

Q. **Define Calorie?**

Ans. A Calorie is the amount of heat required to raise the temperature of one kg of water from 15°C to 16°C. This large Calorie is equivalent to 1000 small calories.

Q. **What is B.M.R?**

Ans. B.M.R. (basal metabolic rate) is the amount of heat produced in the body in a given time in complete state of physical and mental rest at 20°C room temperature.

Q. **How is B.M.R expressed?**

Ans. B.M.R. is expressed as calories per squre metre body surface area per hour. Clinically it is expressed in terms of percentage difference between the determined value an the standard value (as calculated from age, sex, weight and height of a person).

Q. **What is the main source of energy for skeletal muscle?**
Ans. It is glucose.

Q. **What is the main source of energy for cardiac muscle?**
Ans. It is lactic acid.

Q. **What is the main source of energy for brain?**
Ans. It is only the blood glucose.

Q. **What is the source of blood glucose?**
Ans. Blood glucose is solely formed from liver glycogen.

Q. **What is the average daily requirement of insulin?**
Ans. It ranges from 30-50 units/day.

Q. **Define hyperglycaemia.**
Ans. It is increase in blood sugar level byyond its normal limits, e.g. when fasting blood sugar level exceeds 100 mgm%.

Q. **What is glucosuria?**
Ans. Glucosuria is presence of detectible glucose in urine. It occurs, when the blood glucose level crosses its renal threshold (normal 160 mgm%.)

Q. **What is diabetes mellitus?**
Ans. It is a pathological condition evidenced by hyperglycaemia (and glucosuria). It is usually due to deficient insulin secretion or its inactivation.

Q. **What are the causes of hypoglycaemia?**
Ans. These are overdosage of insulin therapy in diabetes mellitus, excessive insulin secretion (hyperinsulinism), deficiency of insulin antagonists, defective glycogenolysis (as in glycogen storage disease of liver), in severl liver damage and after gastric operations.

Q. **What do you understand by glucose tolerance test (GTT)?**
Ans. It is a common clinical laboratory method to investigate the cases of diabetes mellitus and certain other conditions. The patient is kept on about 300 gm earbohydrate diet daily for three days. Fasting sample is collected in the morning, after which the patient is given glucose orally in dose of 1 gm/kg body weight (commonly 100 gm glucose is preferred). The blood and urine samples are collected ½, 1, 1½ and 2 hours intervals: this may be extended beyond 2 hours in certain cases. The blood glucose values are estimated and urine tested for presence of glucose and a graph is pollted.

Q. **What is the normal blood cholesterol level?**
Ans. This is 150-250 mgm%.

Q. **What is lipotropin?**
Ans. Lipotropin is a substance which can reduce fat content of the liver.

Q. **What are essential aminoacids?**
Ans. Certain aminoacids cannot be synthesized in the body and have to be supplied through diet, as these are essential for life being needed for growth, nutrition and health of the body. Therefore these are called essential aminoacids.

Q. **What is the normal blood urea level?**
Ans. It is 15-40 mgm%.

Q. **What is the importance of Iodine in the body?**
Ans. Iodine forms an important constituent of thyroxine and is thus indirectly essential for life.

Q. **What are the main causes of dehydration?**
Ans. It is caused by diarrhea, vomiting, profuse sweating, haemorrhage etc.

Q. **Describe the structure of nephron.**
Ans. A nephron consists of of Malpighian corpuscle (Bowman's capsule and glomerulus), and the renal tubule. The renal tubule in turn is divided as proximal convoluted tubule, Henle's loop with descending and ascending limbs, distal convoluted tubule and collecting tubule.

Q. **What is the mechanism of glomerular filtration?**
Ans. Clomerular filtering membrane acts as an ultra-filter. The glomerular filtration occurs due to glomerular capillary pressure (75 mm Hg), which is opposed by osmotic pressure of plasma proteins (25 mm Hg) and intracapsular pressure (20 mm. Hg).

Q. **What is the rate of blood flow through the kidney?**
Ans. It is 1300 ml/minute (700 ml/minute for plasma).

Q. **What is normal blood urea level?**
Ans. It is 15-40 mgm%.

Q. **What is the physiological capacity of urinary bladder?**
Ans. It ranges from 250 to 450 ml.

Q. **What are the functions of skin?**
Ans. It forms a protective coating of the body and acts as a mechanical barrier against entry of bacteria etc. It regulates body temperature, synthesizes vitamin D, acts as organ of sensation, excretes sweat, absorbs oil, some of drugs etc. stores fat, salt, water, maintains water balance, contributes to body beauty, reflects the age of person, skin pigments protect the body from harsh ultraviolet rays of the sun.

Q. **What are the main functions of sweat?**
Ans. It is concerned with temperature regulation, maintenance of water, electrolyte and acid base balance, and excretory functions. It also keep the skin moist.

Q. **What is dysarthria?**
Ans. Dysarthria is speech disturbance due to defects in excitomotor areas in cortex, pyramidal tract, cranial nuclei, muscles etc.

Q. **How does autonomic nervous system control the cerebral vessels?**
Ans. Autonomic control of the cerebral vessels is rather negligible.

Q. **What is the role of lacrimal secretion?**
Ans. It lubricates the conjunctiva and in addition has bactericid action due to its lysozyme content. Through overflow (tears) it helps to remove the foreign body etc. from the eye.

Q. **What are the main functions of the lens of eye?**
Ans. It serves to refract light and is concerned with the process of accommodation.

Q. **What is astigmatism?**
Ans. It is associated with either myopia or hypermetropia and is due to inequalities in curvatures of vertical, horizontal or diagonal meridians of the cornea, so that there is blurring of the vision.

Q. **What is chromatic aberration?**
Ans. These are due to different wavelengths of coloured rays, but are not of much physiological importance.

Q. **What is colour blindness?**
Ans. It is inability to recognize one or more of colour 5. It is a sex-linked recessive genetic defect found in 1% of males and 0.4% females.

Q. **What is blind spot?**
Ans. This is an area of the optic disc in the retina, where there is no perception of vision.

Q. **What is the range of sound frequencies audible to the human ear?**
Ans. It ranges from 20 to 20,000 cycles per second.

Q. **What is anosmia?**
Ans. It is loss of sense of smell.

Q. **What is the normal body temperature in man?**
Ans. It is 37°C (98.4°F).

Q. **What are the main body temperature regulating factors?**
Ans. Body temperature is regulated through nervous and hormonal control.

Q. **What is pyrexia?**
Ans. It is the state when the body temperature ranges from 37.2C° to 40.5°C (99°F −105°F).

Q. **What is heat stroke?**
Ans. Heat stroke is caused due to high environment temperature causing impairment in body temperature regulating mechanism. The body temperature rises to 41°C to 43°C or even more.

Q. **What is hyporbermia?**
Ans. It is the state when the body temperature falls to 30°C−32°C.

Q. **What is hormone?**
Ans. Any chemical substance synthesized in the body tissues and carried directly by the blood to other parts of the body for its specific actions is termed as hormone.

Q. **Name the endocrine glands, in which the hormones are made up of proteins.**
Ans. These are anterior pituitary, thyroid, parathyroids, Islets of Langerhans in pancreas and the alimentary canal hormones.

Q. **Name the hormones secreted by thyroid gland.**
Ans. These are thyroxine, tri-iodothyronin and thyrocalcitonin.

Q. **How does thyroid gland develop?**

Ans. It is entodermal in origin as median outgrowth at level of first branchial cleft.

Q. **What is the normal concentration of iodine in blood?**

Ans. It is 0.5−1mgm%.

Q. **What are the main functions of thyroxine?**

Ans. The thyroid hormones accelerate the metabolic process with heat production and promote growth, and ensure normal development of central nervous system.

Q. **How do you classify thyroid goitre?**

Ans. Goitre may be simple or toxic. Toxic goiter may be exophthalmic or toxic and nodular type. Simple goiter may be parenchymatous or nodular type.

Q. **Name some of the local hormones in the body.**

Ans. These are acetylcholine, heparin, histamine, serotonin, angiotensin, bradykinin etc.

Q. **Describe briefly the process of ovulation.**

Ans. Ovulation is the process of release of ovum into abdominal cavity after the rupture of Graafian follicle. Rupture of follicular wall is due to activity of proteolytic enzyme regulated by pituitary gonadotrophins. The rupture occurs by thinning of the capsule at a point termed as stigma. The released ovum is surrounded by cumulus cells which are shed away as the ovum passes into fallopian tube from the abdominal cavity.

Q. **What are the functions of placenta?**

Ans. Placenta a supplies nutrients from maternal blood to the foetus, excretes foetal waste products, carries out respiratory functions for foetus, secretes chorionic genadotrophin upto first trimester of pregnancy, and progesterone and oestrogens upto 32-34 weeks of pregnancy.

Q. **How do you broadly classify the immune mechanisms?**

Ans. These are classified into two functional types viz thymus independent system B-cells and thymus dependent system (T-cells).

Q. **What is the mode of function of B-cell system?**

Ans. B-cells function by releasing free antibodies.

Q. **How do T-cells function?**

Ans. The T-cells are responsible for cell-mediated immunity by release of lymphokines.

Q. **Fill in the blanks:**

1. **The human body is made up of 206 bones and _____ muscles**

(a) 500 (b) 600
(c) 700 (d) 800
(e) None of these

2. **Muscles are of _____ types**

(a) 2 (b) 3
(c) 4 (d) 5
(e) None of these

3. Gastric juice secreted by the stomach is made up of ________ salt.

(a) NaCl (b) HCl

(c) NaOH (d) $CaCl_2$

(e) None of these

4. Sanitary system is also termed as ______

(a) Respiratory system (b) Circulatory system

(c) Nervous system (d) Excretory system

(e) None of these

5. Kidneys separate poisonous substances called _____ from the blood.

(a) NH_3 (b) Urea

(c) CO_2 (d) CO

(e) None of these

6. Adam's Apple is also known as ______

(a) Trachea (b) Larynx

(c) Lungs (d) Kidney

(e) None of these

7. The eye ball _____ distinct coats.

(a) 3 (b) 4

(c) 5 (d) 6

(e) None of these

8. The middle coat of eye ball is formed by the ________ and iris.

(a) Sclerotic coat (b) Cornea

(c) Choroid membrane (d) Retina

(e) None of these

9. _____ gives the colour to the eye

(a) Cornea (b) Iris

(c) Pupil (d) Lens

(e) None of these

10. _____ can be brown or blue.

(a) Eyeball (b) Cornea

(c) Retina (d) Iris

(e) None of these

11. The diameter of the pupil can vary from _______ an inch.

(a) $\frac{2}{3}$ to $\frac{4}{3}$ (b) $\frac{1}{3}$ to $\frac{1}{20}$

(c) $\frac{1}{4}$ to $\frac{1}{20}$ (d) $\frac{1}{2}$ to $\frac{1}{10}$

(e) None of these

12. _____ contains more proteins than any other tissue.

(a) Retina (b) Pupil

(c) Lens
(d) Cornea
(e) None of these

13. **Sharpness of the image is associated with _____**
(a) Rods
(b) Cones
(c) Retina
(d) Lens
(e) None of these

14. **There are about _____ million nerve cells in the retina**
(a) Retina
(b) Pupil
(c) Lens
(d) Cornea
(e) None of these

15. **Each kidney contains about _______ millions nephrons**
(a) 1
(b) 1.5
(c) 2
(d) 3
(e) None of these

ANSWERS

1.	(b)	2.	(a)	3.	(b)	4.	(d)	5.	(b)
6.	(b)	7.	(a)	8.	(c)	9.	(b)	10.	(d)
11.	(b)	12.	(c)	13.	(b)	14.	(d)	15.	(a)

Q. Choose the best answer:

1. **Eyeball of eye is moved by muscles _________**
(a) 3
(b) 4
(c) 5
(d) 6
(e) None of these

2. **Lachrymal gland is present in _________**
(a) Ear
(b) Nose
(c) Eye
(d) Mouth
(e) None of these

3. **Colour of the eye is due to _________**
(a) Cornea
(b) Pupil
(c) Lens
(d) Iris
(e) None of these

4. **In human eye lens is_________**
(a) Single concave
(b) Double concave
(c) Single convex
(d) Double convex
(e) None of these

5. **Sclerotic coat is present in_________**
(a) Inner ear
(b) External ear
(c) Eye
(d) Middle ear

(e) None of these

6. **In eye photoreceptor is________**
   (a) Iris (b) Pupil
   (c) Lens (d) Rods and cones
   (e) None of these

7. **As compared to left kidney right kidney is ________**
   (a) Larger (b) Shorter
   (c) Bigger (d) Little above
   (e) None of these

8. **The kidneys are supplied blood by________**
   (a) Coronary artery (b) Illiac artery
   (c) Pelvic artery (d) Renal artery
   (e) None of these

9. **Which part of the body removes waste products from the blood?**
   (a) Kidney (b) Lungs.
   (c) Heart (d) Brain
   (e) None of these

10. **Largest gland in our body is________**
    (a) Pituitary (b) Adrenal
    (c) Testes (d) Liver
    (e) None of these

11. **The number of chambers in the heart are________**
    (a) 2 (b) 3
    (c) 4 (d) 5
    (e) None of these

12. **Pulmonary artery originates from________**
    (a) Right atrium (b) Right ventricle
    (c) Left atrium (d) Left ventricle
    (e) None of these

13. **Pulmonary artery collects the blood from ________**
    (a) Kidney (b) Legs
    (c) Arms (d) Lungs
    (e) None of these

14. **Strongest muscles in our body is ________**
    (a) Heart muscles (b) Legs muscles
    (c) Arm muscles (d) Mouth muscles
    (e) None of these

15. **The artery which supplies blood to the heart are ________**
    (a) Coronary artery (b) Iliac artery
    (c) Carotid artery (d) Renal artery

(e) None of these

16. **Oxygen carrying capacity of blood is due to the presence of ________ metal.**

(a) Magnesium (b) Iron
(c) Nickel (d) Cobalt
(e) None of these

ANSWERS

1.	(d)	2.	(c)	3.	(d)	4.	(b)	5.	(c)	6.	(d)	7.	(b)
8.	(d)	9.	(a)	10.	(d)	11.	(c)	12.	(b)	13.	(d)	14.	(a)
15.	(a)	16.	(b)										

Give the appropriate choice of the following:

Q.

1. **Number of incisors in each jaw of human is ________**

(a) 2 (b) 4
(c) 6 (d) 8
(e) None of these

2. **The dentine which forms the crown of the tooth is covered with a substance ________**

(a) Iron pyrite (b) Aluminium Silicate
(c) Enamel (d) Silica
(e) None of these

3. **Amount of air passes in and out of the lungs in ordinary quite breathing ________**

(a) 10-20 cubic inches (b) 20-30 cubic inches
(c) 30-40 cubic inches (d) 40-50 cubic inches
(e) None of these

4. **The portion of the brain which controls the intelligence is ________**

(a) Cerebrum (b) Cerebellum
(c) Pons varolli (d) Medulla oblongata
(e) None of these

5. **The portion of the brain which is responsible for regulation or coordination of all muscular movements ________**

(a) Cerebrum (b) Cerebellum
(c) Pons varolii (d) Medulla oblongata
(e) None of these

6. **Involuntary movements are controlled by ________**

(a) Cerebrum (b) Cerebellum
(c) Pons varolii (d) Medulla oblongata
(e) None of these

7. **The swallowing activity is controlled by ________**

(a) Cerebellum (b) Cerebrum

(c) Pons varolii
(d) Medulla oblongata
(e) None of these

8. Total number of cranial nerves are ________

(a) 8
(b) 10
(c) 12
(d) 14
(e) None of these

9. Tympanic membrane is responsible for the sense of ________

(a) Sight
(b) Hearing
(c) Smell
(d) Touch
(e) None of these

10. Which part of the ear is responsible for the collection of sound waves?

(a) Pinna
(b) Inner Ear
(c) Middle Ear
(d) Cochlea
(e) None of these

11. Tiger is an example of ________

(a) Herbivores
(b) Omnivores
(c) Predator
(d) Autotrophs
(e) None of these

12. The secretion of lachrymal glands is ________

(a) Tears
(b) Sweat
(c) Saliva
(d) Bile
(e) None of these

13. The non-communicable disease is called

(a) Endemic
(b) Acute
(c) Chronic
(d) Innate
(e) None of these

14. Disease in which of the enlargement of the thyroid gland takes place is ________

(a) Goiter
(b) Leprosy
(c) Addison
(d) Hemophilic
(e) None of these

15. The vaccination against the Diphtheria, Tetanus and Pertussis is ________

(a) DPT immunization
(b) DTP immunization
(c) AGS immunization
(d) ATS immunization
(e) None of these

16. LSD stands for ________

(a) Lysergic Acid Diethylamide
(b) Less soluble drug
(c) Lysogenic stimulating disease
(d) Lipase stimulating drug
(e) None of these

ANSWERS

1.	(b)	2.	(c)	3.	(b)	4.	(a)	5.	(b)	6.	(d)	7.	(d)
8.	(c)	9.	(b)	10.	(a)	11.	(c)	12.	(a)	13.	(d)	14.	(a)
15.	(b)	16.	(d)										

Q. Choose the best answer for the following:

1. Iron deficiency is usually responsible for ________

(a) Anxiety
(b) Allergy
(c) Leprosy
(d) Anemia
(e) None of these

2. An enzyme that causes local vasodilation is ________

(a) Ampicillin
(b) Histamine
(c) Aspirin
(d) Insomnia
(c) None of these

3. A micro-organism produces the acid that allows milk crude to settle into butter milk is ________

(a) Streptococcus lactis
(b) Bacillus subtillus
(c) Bacillus lichniformis
(d) Proteus luteus
(e) None of these

4. A clinical condition in which blood sugar level is below normal ________

(a) Hypoglycemia
(b) Hyperglycemia
(c) Glycosuria
(d) Anemia
(e) None of these

5. A bone of the fore arm is ________

(a) Radius
(b) Femur
(c) Pelvis
(d) Tarsal
(e) None of these

6. Parietal is the bone of ________

(a) Skull
(b) Trunk
(c) Clavicle
(d) Ribs
(e) None of these

7. Mandible is the bone of ________

(a) Skull
(b) Face
(c) Forearm
(d) Tarsal
(e) None of these

8. The human body is made up of ________

(a) 196 bones
(b) 206 bones
(c) 212 bones
(d) 216 bones
(e) None of these

9. **Collar Bone is __________**
(a) Clavicle (b) Scapula
(c) Sternum (d) Ribs
(e) None of these

10. **Gastric juice contains __________**
(a) Hydrochloric acid (b) Carbonic acid
(c) Sulphuric acid (d) Nitric acid
(e) None of these

11. **Larynx or voice box is commonly known as __________**
(a) Adams' apple (b) Cochlea
(c) Femur (d) Ulna
(e) None of these

12. **Which one of the following involuntary muscle is __________**
(a) Legs (b) Stomach
(c) Arms (d) Fingers
(e) None of these

13. **The heart weight of adult person is __________**
(a) 8 ounce (b) 9 ounce
(c) 10 ounce (d) 15 ounce
(e) None of these

14. **The blood vessel which conveys the blood from left side of the heart to all parts of the body is __________**
(a) Aorta (b) Pulmonary artery
(c) Inferior vena cava (d) Pulmonary veins
(e) None of these

15. **Liver prepares __________**
(a) Starch (b) Glycogen
(c) Proteins (d) Carbohydrates (e) None of these

16. **Which part of the body maintain the electrolytic balance?**
(a) Kidney (b) Lungs
(c) Liver (d) Legs (e) None of these

ANSWERS

1.	(d)	2.	(b)	3.	(a)	4.	(a)	5.	(a)	6.	(a)	7.	(b)
8.	(b)	9.	(a)	10.	(a)	11.	(a)	12.	(b)	13.	(b)	14.	(a)
15.	(b)	16.	(a)										

Q. True or False:

1.	Sacrum is trunk bone.	True/False
2.	Those muscles which move the bones are called tendons.	True/False

3.	The middle coat of eye formed by the sclerotic coat.	True/False
4.	The lens of eye is made up of fibrous cells which contain proteins.	True/False
5.	The kidneys are supplied with blood by the renal veins.	True/False
6.	The liver has the power of attesting various poisonous substances from blood.	True/False
7.	The weight of heart is about nine ounce in an adult.	True/False
8.	The blood is alkaline fluid.	True/False
9.	The colour of blood is due to nitrogenous substances.	True/False
10.	The blood also moistens the various tissues.	True/False
11.	The human skin is made up of four layers.	True/False
12.	The human skin absorbs oil and some drugs from its surface.	True/False
13.	The compact tissue of bone differs from tooth in composition.	True/False
14.	The surface of brain covered with a pia matter.	True/False
15.	The human body has about 37 sensing organs.	True/False
16.	The internal ear consists of very simple cavity with bone.	True/False

ANSWERS

1. (T)	2. (T)	3. (F)	4. (F)	5. (F)	6. (T)
7. (T)	8. (T)	9. (T)	10. (T)	11. (F)	12. (T)
13. (F)	14. (T)	15. (F)	16. (F)		

MORE COMMON

Vaccines	Medicines	Painkillers
B.C.G.	Aspirin	Mouphine
Rabies antitoxin	Calpol	Pethidine
Heppacine	Dispirin	Sosegon
Pertussis	Resochin	Temgesic
Tetanous Antitoxin	Entamizole	Dicloran
Yellow fever	Diazepam	Synflex
Cholera	Panadol	
Diphtheria	Paraacitamole	

MULTIPLE CHOICE QUESTIONS

MEDICAL

1. Florence Nightingale was an extraordinary nurse. She made scientific contribution in:
(a) Blood transfusion (b) Medical statistics
(c) Genetics (d) Anthropology

2. Who was the first to get Nobel Prize in Medicine?
(a) R.Ross (b) E.A. Von Benning
(c) N.R. Finsen (d) C.Golgi

3. The rate of growth of the human body is different at different periods of life. At what pace is the rate fastest?
(a) Between ages 8 and 13 (b) Between ages 10 and 16
(c) Between ages 15 and 21 (d) Between ages 18 and 25

4. Lymph glands are found in the course of the Lymph flow in many parts of the human body. They are particularly numerous in the neck, the arm-pits, the groins and in the wall of the alimentary canal. In these sites they are strategically placed to filter-off microorganisms absorbed by some of the main surfaces of the body before these organisms enter the:
(a) Blood (b) Tears
(c) Saliva (d) Sweat

5. What is meant by Thrombosis many people die of this?
(a) Cardiac arrest.
(b) Sudden death of the brain, leading to a collapse of the heart.
(c) Obstruction of the artery or vein by a clot of blood.
(d) Obstruction of artery only by a clot of blood

6. What disease is called Gingivitis?
(a) Stammering (b) Itching of feet
(c) Inflammation of gums. (d) Periodic bleeding from the nose.

7. A vaccine is compulsorily administered some weeks before delivery in good maternity hospitals. Name the vaccine.
(a) Hepatitis (b) Tetanus
(c) Sabin vaccine (d) BCG.

8. The IQ of a genius person is usually rated above 140. What is your guess about the IQ of normal intelligent person?
(a) 75 (b) 80
(c) 115 (d) 100.

9. Reading of the Snellen chart is the first eye test a specialist administers to the patient in case of poor vision. What is the distance from which this chart is meant to be read?
(a) 6 metres (b) 3 metres
(c) 4 metres (d) 5 metres

10. What is the main symptom of Down's syndrome?
    (a) Total loss of retentive memory.
    (b) Stammering
    (c) Rickety appearance
    (d) Severe mental and physical retardation.

11. What is the average rate of growth of pair on a normal human head?
    (a) 3 inches every six months
    (b) 1 inch in 4-6 weeks.
    (c) 6 inches every month
    (d) 2 inches in two weeks.

12. Pain is the most uncomfortable situation for the human body. Name the instrument which can even measure the intensity of pain.
    (a) Achimeter
    (b) Algometer
    (c) Poinemeter
    (d) Penstetho

13. When was Penicillin discovered?
    (a) 1930
    (b) 1929
    (c) 1928
    (d) 1927

14. What should be the average daily quantity of urine produced in a healthy person?
    (a) 2 litres
    (b) 1.5 litres
    (c) 1 litre
    (d) 2.5 litres

15. Name the largest gland of the human body.
    (a) The liver
    (b) The pituitary gland
    (c) The heart
    (d) The thyroid gland

16. About how many taste buds are present on the human tongue?
    (a) Around 1000
    (b) Around 2000
    (c) Around 2500
    (d) Around 3000

17. There are about six hundred muscles in a human body. Name the part of the body which contains the strongest muscle.
    (a) Thighs
    (b) Jaws
    (c) Hips
    (d) Pelvis

18. What are diurectics?
    (a) A medicine which induces one to vomit.
    (b) A medicine which helps urine production.
    (c) A medicine which acts as a laxative.
    (d) A medicine to decrease the blood pressure

19. How long does the brain take to die after the stoppage of blood circulation?
    (a) It dies immediately
    (b) 60 seconds
    (c) Two minutes
    (d) Three minutes.

20. Antibiotics are selectively toxic and usually are accompanied by harmful side effects. What is the possible side effect of streptomycin?
    (a) Diarrhoea
    (b) Deafness
    (c) Dysenentry
    (d) Numbness.

21. There are four blood groups in all:
A, B, AB and O, which one of these is known as the Universal Donor?
(a) B (b) A
(c) AB (d) O

22. What should be the daily average quantity of urine production in a healthy body?
(a) 1 litre (b) 1.5 litres
(c) 2 litres (d) 2.5 litres

23. Formation of gallstones in the gall bladder is a result of:
(a) Deposits of calcium in drinking water.
(b) Taking fatty foods in excess.
(c) Crystallization of bile.
(d) Crystallization of acid from the gastric juice.

24. What is the source of energy for the human brain?
(a) Vitamin A (b) Glucose
(c) Proteins (d) Phosphorous

25. About how much blood does the heart of an average human being pump every minute?
(a) 6.2 litres (b) 5.2 litres
(c) 4.2 litres (d) 3.2 litres

26. Name the disease caused by the excess of uric acid in the human body.
(a) Diabetes (b) Rickets
(c) Gout (d) Incontinence.

27. How many bones are present in a human adult?
(a) 200 (b) 206
(c) 204 (d) 205

28. Head or Skull of the human body is divided into two major parts, Cranium and Face for anatomy purposes. Cranium contains 8-bones. How many bones are present in the face?
(a) 4 (b) 10
(c) 12 (d) 14

29. Which of the following is not a bone of the face?
(a) Mandible bone (b) Nasal bone
(c) Parietal bone (d) Maxilla bone

30. Vertebral column is the central portion of the osseous system. It is composed of series of bones called vertebrae and forms a kind of axis with which all the other parts of the skeleton are connected in the human body. What are the total number of bones in the vertebral column?
(a) 28 (b) 30
(c) 33 (d) 32

31. The bones of the neck of the human body are called cervical bones These are used in the movement of the neck What are the total number of bones in the neck?

(a) Seven
(b) Six
(c) Five
(d) Four

32. Neck, Back, Loins, Sacrum and Coccoyx are the parts of the Vertebral column. Bones of the Back support the ribs and are also called Dorsal bones. What is their number?

(a) 8
(b) 12
(c) 10
(d) 14

33. How many movable vertebrae belong to the Loins? These are also called as Lumbar vertebrae?

(a) Five
(b) Six
(c) Seven
(d) Four

34. There are two collar bones at the base of the neck and in front of shoulders. What is the other name for collar bone?

(a) Scapula
(b) Sternum
(c) Clavicle
(d) Rib

35. There are two shoulder bones at the top of the back in the human body. It is a large flat triangular shoulder blade. Shoulder bone is also called as:

(a) Sternum
(b) Pelvis
(c) Scapula
(d) Clavicle

36. The ribs from a kind of bony cage to protect the heart and lungs. These are attached at the back to the backbone. What is their number?

(a) 24
(b) 22
(c) 20
(d) 18

37. Name the largest bone of the human body?

(a) Fibula
(b) Femur
(c) Ulna
(d) Humerus.

38. The bone of the upper arm is very strong and consists of a long portion called the shaft and two enlarged extremities called the Heads. What is the other name for this bone?

(a) Ulna
(b) Radius
(c) Humerus
(d) Carpal.

39. The bone of the forearm-extends from elbow to wrist. It is thick at its upper extremity which forms a hinge joint. This bone is also called as:

(a) Ulna
(b) Phalanges
(c) Carpal
(d) Radius

40. The wrist is composed of small bones, called carpal bones. What is their number?

(a) Five
(b) Six
(c) Seven
(d) Eight

41. What bone of the human body is also called as the calf-bone?

(a) Fibula
(b) Tarsal
(c) Tibia
(d) Metatarsal.

42. Blood is a vital fluid connective tissue in the body consisting of plasma and formed elements like RBC's, WBC's and platelets. What is the normal life span of RBCs (Red Blood Cells)?

(a) 100 days
(b) 110 days
(c) 120 days
(d) 130 days

43. Anemia is a clinical condition, which occurs due to subnormal amount of Hb and mumber of RBC in the body. What is normal Hb value?

(a) 14.5 to 1.5 gm%
(b) 13.5 to 14 gm%
(c) 12.5 to 13 gm%
(d) 11.5 to 12 gm%

44. Blood platelets are one of the formed elements of blood; being tiny cytoplasmic structures with granules but no nucleus and are derived from megakaryocytes. What is the normal life span of blood platelets?

(a) 3-8 days
(b) 4-9 days
(c) 5-11 days
(d) 6-13 days

45. What is the pH of normal blood?

(a) 5.3-6.4
(b) 6.3-7.3
(c) 7.3-7.4
(d) 7.0-8.0

46. What is normal clotting time?

(a) 5 to 8 minutes
(b) 4 to 7 minutes
(c) 3 to 6 minutes
(d) 2 to 5 minutes.

47. What is abnormal clotting time?

(a) 5 to 6 minutes
(b) 4 to 5 minutes
(c) 3 to 4 minutes
(d) 1 to 3 minutes

48. Which vitamin serves to maintain the plasma prothrombin level and thus the normal coagulability of blood?

(a) Vitamin C
(b) Vitamin K
(c) Vitamin D
(d) Vitamin A.

49. Who discovered circulation of blood?

(a) William Harvey
(b) Alexander Fleming
(c) Keith
(d) Flack.

50. The colour of the blood is due to the presence of the nitrogenous substance, called haemoglobin, in the red corpuscles. This substance contains a considerable proportion of a metal, and has the power of combining with oxygen. Name the metal.

(a) Sodium
(b) Potassium
(c) Iron
(d) Zinc.

51. The heart is a hollow muscular organ which by its contraction, forces the blood through the whole system of blood-vessels. How many cavities are present in a human heart?

(a) Two
(b) Three
(c) Four
(d) Five

52. The frequency of the heart beating varies considerably with the age, activity and various other circumstances. What is the average rate for an adult?

(a) 70 to 60 per minute
(b) 80 to 70 per minute
(c) 90 to 80 per minute
(d) 100 to 90 per minute.

53. The main phases of cardiac cycle are auricular systole, ventricular and general diastole. What is the normal duration of cardiac cycle?
(a) 0.9 seconds
(c) 0.7 seconds
(b) 0.8 seconds
(d) 0.6 seconds

54. Blood pressure is a lateral pressure exerted by blood on the vessel walls during its flow. Who discovered the measurement of blood pressure in 1733?
(a) R. Stephen Hales
(b) William Harvey
(c) Haldene
(d) William Stockes.

55. Myocardium is a term used in connection with the cardiovascular descriptions. Which of the following statements corresponds to it correctly?
(a) It is a part of a clot which breaks away and circulates through the blood stream.
(b) It is the middle layer of the heart wall which is composed of cardiac muscle.
(c) It is an accident to part of the brain caused by an alternation in the blood flow.
(d) It has something to do with the blood vessels.

56. The phase of contraction of the heart is called the Systole. Systolic pressure is the minimum pressure recorded during systole and indicates the maximum work of the heart. What is the normal value of systolic pressure?
(a) 120-125 mmHg
(b) 115-120 mmHg.
(c) 110-115 mmHg.
(d) 100-110 mmHg.

57. The phase of relaxation of the heart and rest is known as the Diastole. Diastolic pressure is the minimum pressure recorded during diastole and indicates the resistance which the heart has to overcome while the aortic valves are open. What is the normal value of diastolic pressure?
(a) 60 mmHg
(b) 70 mmHg
(c) 80 mmHg
(d) 90 mmHg.

58. The difference between systolic pressure and diastolic pressure is called the pulse pressure. What is the normal value of pulse pressure?
(a) 10 mmHg
(b) 20 mmHg
(c) 30 mmHg
(d) 40 mmHg.

59. Blood pressure depends on systolic force, cardiac output and peripheral resistance. The blood pressure is measured with an instrument called Sphygmomano-meter which is aneroid or mercurial type. Who discovered this instrument?
(a) R. Stephen Hales
(b) Riva Rocci
(c) William Harvey
(d) Keith.

60. Which one of the following is not a cardio-vascular disease?
(a) Myocarditis
(b) Arterio-sclerosis
(c) Mitral Stenosis
(d) Neurasthenia.

61. Respiration is the result of the alternate expansion and contraction of the walls of the chest. What is the normal respiratory rate in an adult?
(a) 14-16 per minutes
(b) 16-18 per minutes

(c) 15-17 per minutes
(d) 18-20 per minutes.

62. The amount of air given out by forced expiration after the end of quite expiration is called:

(a) Residual volume
(b) Expiratory reserve volume
(c) Minimal volume
(d) Complemental volume.

63. Inspiratory capacity is the amount of air taken in with maximum deep inspiration. What is its approximate value?

(a) 1.5 litres
(b) 2.0 litres
(c) 2.5 litres
(d) 3.0 litres

64. Total lung capacity is the amount of air in the lungs after maximum deep inspiration. It is equal to sum of vital capacity and residual volume. What is its approximate value?

(a) 3.5 litres
(b) 4.5 litres
(c) 5.5 litres
(d) 6.5 litres.

65. Which one of the following corresponds to the composition of expired air?

(a) 15.4% Oxygen, 5.1% Carbondioxide and 79.5% Nitrogen
(b) 16.4% Oxygen, 4.1% Carbondioxide and 79.5% Nitrogen.
(c) 16.4% Oxygen, 3.1% Carbondioxide and 80.5% Nitrogen.
(d) 14.4% Oxygen, 4.1% Carbondioxide and 80.5% Nitrogen.

66. Maximum ventilation volume is the maximum ventilation in litres per minute. What is this approximate volume?

(a) 40 litres
(b) 60 litres
(c) 80 litres
(d) 100 litres.

67. A condition in which there is an excess of Carbondioxide in the body fluids is called ________

(a) Tachypnoea
(b) Bradypnoea
(c) Hypercapnoea
(d) Hypernea

68. A condition in which there is an increased rate and amplitude in breathing is called:

(a) Hypernoea
(b) Dyspnoea
(c) Bradypnoea
(d) Apnoea.

69. A condition in which there is a decreased amount of oxygen in blood is called:

(a) Anoxia
(b) Anoxaemia
(c) Apnoea
(d) Dyspnoea

70. Apnoea is a temporary cessation of breathing. It is caused by forced and rapid pulmonary ventilation, which reduces CO_2 tension in blood and inhibits respiratory centre. There are different types of apnoea. Which of the following apnoea is due to change in blood pressure?

(a) Voluntary apnoea
(b) Vagal apnoea
(c) Apnoea Vera
(d) Acpnic apnoea.

71. A gland is an organ which has the power of separating certain materials from the blood which flows through it. Glands are of two kinds; secreting and excreting.

Salivary glands are the examples of secreting glands. How many they are in number in a human body?

(a) One pair
(b) Two pairs
(c) Three pairs
(d) Four pairs.

72. Saliva is the fluid secreted by the salivary glands. Saliva is a transparent, watery liquid, slightly alkaline in its action. What is the active constituent of saliva which has digestive properties?

(a) Water
(b) Ptyalin
(c) Pepsin
(d) Sodium chloride.

73. Which of the following glands prepares and separates a fluid from the blood?

(a) Excreting gland
(b) Secreting gland
(c) Ductless gland
(d) None of the above.

74. Endocrine gland is ductless gland which secretes the chemical substances called hormones directly into blood circulation. Which of the following is not an endocrine gland?

(a) Adrenal cortex
(b) Pancreas
(c) Ovaries
(d) Salivary.

75. Thyroid-gland is made up of two parts and is shaped like a bow. Its secretion affects physical and mental development in children and adults. Name the hormone secreted by thyroid gland?

(a) Testosterone
(b) Cortisol
(c) Thyroxine
(d) Insulin.

76. Which of the following elements is an essential part of the hormones secreted by the thyroid gland?

(a) Chlorine
(b) Bromine
(c) Iodine
(d) Fluorene.

77. The thyroid hormones accelerate the metabolic processes with heat production and promote growth, and ensure normal development of the central nervous system. What is the normal daily secretion of thyroxine?

(a) 50-100ug.
(b) 100-150ug.
(c) 150-250 ug.
(d) 200-300 ug.

78. Thyroid hormone, thyroxine is formed by the stepwise iodination of tryosine. The accomplishment of this step needs suffecient iodine in the blood. What is the normal concentration of iodine in blood?

(a) 0.5-1 mg%
(b) 1.0-1.5 mg%
(c) 1.5-2.0 mg%
(d) 2.0.-2.5 mg%

79. Name the disease caused by the deficiency of iodine in the human body.

(a) Anemia
(b) Goitre
(c) Rickets
(d) Filaria.

80. Name the main hormone secreted by placenta during pregnancy.

(a) Growth hormone
(b) Choroinc gonadotrophin
(c) Cortisol
(d) Aldosterone.

81. Which of the following is a female sex-hormone?
(a) Testosterone (b) Progesterone
(c) Insulin (d) Cortisol.

82. Which of the following is a male sex-hormone?
(a) Insulin (b) Cortisol
(c) Testosteron (d) Thyroxine.

83. Which of the following endocrine glands is also called as the master gland?
(a) Thyroid (b) Adrenal
(c) Pituitary (d) Pancreas.

84. Pancreas gland is shaped like a tongue. It lies just below the stomach. Its secretions help to control the level of sugar in the blood. Name the hormone secreted by pancreas.
(a) Human growth (b) Insulin
(c) Cartisol (d) Thyroxine.

85. Cortisol is a hormone secreted by Adrenal gland. It stimulates conversion of proteins to carbohydrates. What is the normal daily cartisol secretion in the body?
(a) 10-20 mg. (b) 20-30 mg.
(c) 12-50mg (d) 10-30 mg.

86. The digestive system of the human body is a long system: Which of the following is an important part of the digestive system?
(a) Mouth and Oesophagus
(b) Stomach and liver
(c) Pancreas, small and large intestines
(d) All the above

87. Enzymes are biological catalysts secreted in the human body in various juices. Which of the following is not a digestive enzyme present in the gastric juice?
(a) Pepsinogen (b) Amylase
(c) Renin (d) Lipase

88. Which of the following is not a digestive enzyme present in the pancreatic juice?
(a) Trypsinogin and Chymotrypsinogen
(b) Amylase
(c) Stypsin (d) Renin.

89. What is the action of Amylopsin digestive enzyme?
(a) It converts carbohydrates into proteins.
(b) It converts starch into Maltose.
(d) It converts starch into sucrose.

90. What is the action of stypsin or Lypase?
(a) It converts fat into glycerol and fatty acids.
(b) It converts proteins into amino acids.
(c) It converts starch into sucrose.
(d) It converts starch into maltose.

91. The gastric fluid is a clear and colourless liquid, having a slightly saltish and acid taste. Pepsin is the active principle of the gastric fluid. It helps in the digestion of:

(a) Carbohydrates (b) Proteins

(c) Fats (d) Minerals

92. The changing of the food into chyme by the gastric fluid is called chymification. The average time taken in producing this change is from three to four hours. Which of the following foods will take maximum time for chymification?

(a) Boiled rice (b) Raw apples

(c) Fried egg (d) Baked potatoes.

93. The pancreatic juice is a colourless and transparent fluid, which is slightly alkaline. It converts starchy foods into soluble grape-sugar. It also emulsifies:

(a) Carbohydrates (b) Proteins

(c) Fats (d) Minerals.

94. Which of the following converts sucrose into fructose and glucose?

(a) Lactase (b) Maltase

(c) Sucrase (d) Araginase.

95. The bile is a yellow or greenish-yellow fluid secreted continuously by the liver. It is slightly alkaline. Which of the following is a chief use of the bile?

(a) It assist in the emulsification of fats

(b) It moistens the mucous membrane of the intestine

(c) It acts as a natural purgative.

(d) All the above.

96. Which of the following foods are digested in the intestines by the bile and the pancreatic juice?

(a) Carbohydrates (b) Proteins

(c) Fats (d) Minerals.

97. What is the normal daily secretion of bile?

(a) 0.2 to 0.5 litre (b) 0.5 to 1.0 litre

(c) 1.0 to 1.5 litre (d) 1.0 to 2.0 litres

98. Which of the following is not digested in the human body?

(a) Starch (b) Cellulose

(c) Glucose (d) Sucrose.

99. Name the bile pigment present in the bile juice.

(a) Bilirubin (b) Biliverdin

(c) Both (a) and (b) (d) Neither (a) nor (b).

100. Which of the following juice is prepared by the liver in the human body.

(a) Pancreatic juice (b) Bile juice

(c) Gastric juice (d) None of the above.

101. The nervous system consists of two distinct parts, called the cerebro-spinal and the sympathetic systems. Which of the following is an important part of cerebro-spinal system?

(a) Brain (b) Spinal cord
(c) Skin (d) All the above.

102. Under the anatomical classification of central nervous system, how many cranial nerves are present in the brain?
(a) 6 pairs (b) 8 pairs
(c) 12 pairs (d) 16 pairs.

103. Neurons are the nerve cells with ail their branchings. Neurons are classified as unipolar, bipolar and multipoiar. Which of the following common sensations is not concerned with unipolar types?
(a) Pain (b) Touch
(c) Temperature (d) Smell.

104. Basket-like structures in the hair follicles meant for fine touch sensation are called:
(a) Tactile corpuscles (b) Meissner's corpuscles
(c) Pacinian corpuscles (d) Karuse's end bulbs

105. Name the clinical condition in which there is an inability to write:
(a) Alexia (c) Aphasia
(b) Agraphia (d) Dysarthria.

106. Sweating is blessing. It is concerned with temperature regulation maintenance of water, electrolyte and acid-base balance and excretory functions. What is the average daily sweat secretion in a human body?
(a) One quarter of a litre. (b) Two quarters of a litre.
(c) Three quarters of litre. (d) One litre.

107. Sleep is a periodic resting stage for the body especially cerebral cortex. Which one of the following is a subjective symptom of sleep?
(a) Drowsiness and difficulty in keeping the eyes open.
(b) Dryness of conjuctiva
(c) General muscular relaxation
(d) All the above.

108. The organ of vision consists of the eyeball which, with its muscles, blood vessels, nerves, fatty tissue and other protecting structures completely fill the orbit or eye-socket. What is the genera! shape of the eye-ball?
(a) Circular (b) Globular
(c) Rectangular (d) Elliptical

109. The eyeball is moved by two types of muscles namely straight and oblique. What is their total number?
(a) Six (b) Five
(c) Four (d) Three

110. Name the most front part of the eye.
(a) Iris (b) Cornea
(c) Lens (d) Aquous humour.

111. The cornea forms the prominent spherical surface. It is clear and transparent and covers the front of the eye. Name the country whioh is famous for cornea -donations.

(a) India
(b) Bhutan
(c) Indonesia
(d) Sri Lanka.

112. The iris is the circular curtain, seen through the cornea, which gives colour to the eyes. It is perforated in its centre by a circular aperture called the pupil. Iris is a Latin word, it means:

(a) Door
(b) Window
(c) Hole
(d) Opening

113. Close behind the iris in an eye, is a transparent solid body called the crystalline lens. What is this lens called?

(a) Concave
(b) Convex
(c) Doubly convex
(d) Doubly concave.

114. Name that part of the eye where image is formed,

(a) Cornea
(b) Iris
(c) Pupil
(d) Retina

115. The space between the cornea in front and the iris and lens behind is filled with watery liquid known as the:

(a) Vitreous humour
(b) Aquous humour
(c) Aqua pura
(d) None of the above.

116. The retina has the power of retaining the impressions made on it for a short time. Mention this time.

(a) About $\frac{1}{6}$th of a second
(b) About $\frac{1}{8}$th of a second.
(c) About $\frac{1}{7}$th of a second
(d) About $\frac{1}{9}$th of a second

117. Some persons are colour blind , that is, they cannot distinguish between two or more colours. This is probably due to a defect in the:

(a) Cornea
(b) Retina
(c) Pupil
(d) Iris.

118. Which of the following is a part of the refractive media of the eye?

(a) Cornea
(b) Aquous humour
(c) Lens and vitreous humour
(d) All the above.

119. Name the clinical condition in which distant objects are not seen clearly while vision is normal for near objects.

(a) Hypermetropia
(b) Myopia
(c) Astigmatism
(d) Cataract.

120. Name the clinical condition in which near objects are not seen clearly.

(a) Myopia
(b) Hypermetropia
(c) Ametropia
(d) Astigmatism

121. How is Myopia corrected?

(a) By using convex lens
(b) By using concavo-convex lens.
(c) By using concave lens.
(d) By using double convex lens.

122. A deviation from normal refractory state of the eyes is called:

(a) Emmetropia (b) Ametropia

(c) Myopia (d) Hypermetropia.

123. What is the other name for nightblindness?

(a) Dark adaptation (b) Nyclopia

(c) Visula acuity (d) Spherical abberation.

124. The ear consists of three parts, the external ear, the middle ear and the internal e What is the other name for the internal ear?

(a) Labyrinth (b) Tympanum

(c) Auditory canal (d) Pinna.

125. The pinna is a part of the ear which is especially adapted for the collection of sou waves which are reflected by it into the canal. The pinna belongs to which part of t ear?

(a) Middle ear (b) Internal ear

(c) External ear (d) None of the above.

126. What is the average range of sound frequencies audible to the human ear?

(a) 5 to 5,000 cycles per second.

(b) 10 to 10,000 cycles per second.

(c) 15 to 15,000 cycles per second.

(d) 20 to 20,000 cycles per second

127. What is the unit for sound intensity?

(a) Richter (b) Erg

(c) Decible (d) Newton.

128. The internal ear consists of a very complex cavity hollowed out of the bone, whi contains a similar cavity bounded by memebranous walls. Which of the following not a part of the internal ear?

(a) Cochlea (b) Vestibule

(c) Semincircular canals. (d) Malleus.

129. What is Ansomia?

(a) Loss of sleep (b) Loss of sense of smell

(c) Loss of appetite (d) Loss of speech.

130. Which of the following is not a disease of the eye?

(a) Photophobia (b) Diplopia

(c) Tnsomia (d) Proptosis.

131. Deafness is of four types. Name the deafness caused by the disturbances of t external or middle ear preventing normal sound transmission.

(a) Sensorineural deafness

(b) Conductive deafness

(c) Mixed deafness

(d) Functional deafness.

132. Hepatitis is a viral disease and it appears as jaundice. Hepatitis is of more than one kind. Which one of the following is more deadly?

(a) Hepatitis A
(b) Hepatitis B
(c) Hepatitis C
(d) Hepatitis E.

133. Hepatitis-B is a killer disease caused by a virus (HBV). It is more infectious than AIDS. About how many times Hepatitis-B is more infectious than AIDS?

(a) 10 times
(b) 30 times
(c) 50 times
(d) 100 times.

134. Hepatitis-B is transmitted by:

(a) Blood
(b) Sweat and tears
(c) Semsen
(d) All the above.

135. About how many deaths occur by Hepatitis B per annum worldwide?

(a) 1-2 thousands
(b) 1-2 hundred thousands
(c) 1-2 millions
(d) 1-2 hundreds.

136. Hepatitis B causes the inflammation of which part of the human body?

(a) Heart
(b) Liver
(c) Lungs
(d) Kidneys

137. Puberty is the age when a child enters adulthood. It marks the onset of reproductive activity, when there is functional development of gonads alone with the appearance of secondary sex characteristics. What is the average age of onset of puberty in males?

(a) 12-15 years
(b) 11-14 years.
(c) 10-13 years
(d) 13-16 years.

138. What is the average age of onset of puberty in females?

(a) 10-13 years
(b) 12-14 years
(c) 12-15 years
(d) 11-14 years

139. What is the normal spermatozoa total count in the semen?

(a) From 50-100 million per c.c.
(b) From 100-150 million per c.c.
(c) From 100-200 million per c.c.
(d) From 80-120 million per c.c.

140. Menstruation is cyclical bleeding from the uterus of adult females at intervals. What is the average interval?

(a) 27 days
(b) 28 days
(c) 29 days
(d) 30 days

141. There are three phases of menstrual cycle. Which of the following is the first phase of the cycle.

(a) Proliferative phase
(b) Bleeding phase
(c) Secretory phase
(d) None of the above

142. Menopanse is marked by cessation of menstruction in females alongwith atrophy of primary and and accessory sex organs. At what age the menopause sets in females?

(a) 40-45 years (b) 45-50 years
(c) 45-55 years (d) 50-55 years.

143. Man's most precious treasure is the genetic heritage which guides the health and proper development of future generations Undoubtedly, one of the most significant subdivisions of the medical science in the present day world is Genetics. Who coined the term Genetics?

(a) Bateson (b) Alexandre Fleming
(c) Waldeyer (d) T.H. Morgan.

144. An obscure Austrian monk Gregor Mendel launched the field of genetics, but research over the past four decades has revolutionised it. With the new technologies of generic engineering, every facet of modern medicine is now being transformed. When did Gregor Mendel launch this field?

(a) 1665 (b) 1765
(c) 1865 (d) 1965

145. Genetics enjoys the relationship with other sciences. A branch of science which is concerned with the genetic aspects of immunity mechanisms is called:

(a) Clinical genetics (b) Immunogenetics
(c) Biochemical genetics (d) Cytogenetics

146. Chromosomes are thread like structures present in the nucleus of a cell. The term chromosome was introduced into the scientific vocabulary in 1888 by:

(a) Waldeyer (b) James Waston
(c) Mendel (d) Nirenberg.

147. The number of chromosomes in each cell is fixed for a particular species What is its number in human beings?

(a) 42 (b) 44
(c) 46 (d) 48

148. Which pair of chromosome determines the gender of a person?

(a) 21st (b) 22nd
(c) 23rd (d) 20th

149. Genes are theoretical units of inheritance stored in chromosomes. The term 'gene' was introduced in 1909 by:

(a) Johannsen (b) Mendel

150. About how many genes are contained in the nucleus of each cell of human body?

(a) 5,000 (b) 10,000
(c) 15,000 (d) 20,000.

151. DNA (Deoxyribose Nucleic Acid) is the chemical basis of genes and is, indeed, the hereditaiy material. Genes act through controlling the protein constitution of cells Who discovered DNA?

(a) Martha Chase (b) Alfred Hershey
(c) Johann Friedrich Mieschner (d) Paul Berg.

152. DNA is the blueprint of life. It is mis substance that transmits inherited characteristics from one generation to the next. The discovery of double helix structure of DNA awarded 1962 Nobel Prize to:

(a) James Waston and Francis Crick
(b) Rosolind Frankllin
(c) Maurice Wilkins
(d) All the above.

153. Marshal Nirenberg, Har Khorana and Robert Holley cracked the genetic code. They deciphered the "language" that enables DNA to be translated into proteins, the building blocks of all living cells. DNA's code consists of varying combinations of just four bases. They all shared the Nobel Prize in:

(a) 1965
(b) 1966
(c) 1967
(d) 1968

154. The human genome project will cost at beast $ 3 billion and take 15 years. Its aim is to map all the genes in the human cell to provide a key to the vast book of life. Who is the Chairman of this project?

(a) James Waston
(b) Francis Crick
(c) Leorey Hood
(d) Raymond White.

155. What is the expected year for the completion of the human genome project?

(a) 2001
(b) 2002
(c) 2005
(d) 2004

156. The two strands of DNA molecule are held together by hydrogen bonds between the bases of respective strands. These nitrogenous bases are: Adenine, Thymine, Guanine and Cytosine. About how many bases are present in the human genome?

(a) Three hundred thousand
(b) Three million
(c) Three billion
(d) Three thousand.

157. Necleic acids are of two types; DNA and RNA. These are called molecules of life. DNA has a double stranded structure while RNA has single stranded structure. Which of the following bases is not the part of DNA molecule?

(a) Adenine
(b) Uracil
(c) Cytosine
(d) Guanine

158. Cell multiplication takes place by cell division and basically, there are two types of cell division namely Mitosis and Meiosis. How many cells result in Mitosis?

(a) 2 cells
(b) 3 cells
(c) 4 cells
(d) 6 cells.

159. The nucleus of each cell of the human body contains 46 chromosomes, arranged in 23 pairs. Each pair has a set of specific functions to do, piseases occur due to the malfunction of chromosomes. To which chromosome pair is related cystic Fibrosis?

(a) 12
(b) 7
(c) 2
(d) 10

160. The immune system of the human body is one of nature's most remarkable creations. It consists of a complex network of billions and billions of highly specialized cells as well as a staggering array of potent hormones. Which of the following immune cells tracks down and destroys body cells infected with microbes?

(a) B cell (b) Helper T cell

(c) Killer T cell (d) MHC

161. Name the linchpin of the entire immune system ________ the chemical that allows T cells to "see" the presence of foreign invaders and perform their various defensive functions.

(a) MHC (Histo-compatibility Complex Molecule).

(b) Antigen (c) Macrophage

(d) Antibody.

162. Drug dependence is not a new phenomenon. People have been using drugs to forget their miseries, relieve pain and experience pleasant sensations since prehistoric times. The use of drugs inconsistent with or unrelated to the acceptable medical practice is termed as:

(a) Drug dependence (b) Drug abuse

(c) Tolerance (d) Drug Habituation.

163. Which of the following drugs are abused in Pakistan?

(a) Morphine (b) Cocaine

(c) Hashish (d) All the above.

164. Dependence-producing drugs can be classified according to their origin, structure and functions. A major class is opiates or Narcotics. Opiates are those drugs which have opium — like effects and produce psychological as well as Physical Dependence. Which one of the following drugs does not belong to opiate family?

(a) Pethidine (b) Methadone

(c) Temgesic (d) Codeine.

165. Opiates may be naturally occurring semi-synthetic or synthetic. Which one of the following is not a synthetic opiate?

(a) Pethidine (b) Methadone

(c) Temgesic (d) Codeine

166. Which one of the following opiate has the chemical name Diacetylmorphine?

(a) Opium (b) Heroin

(c) Sosegon (d) Pethidine.

167. Sedatives or Hypnotics are those drugs which cause sedation or produce sleep. This drug causes both psychological as well as physical dependence. Which one of the following is not a sedative?

(a) Barbiturate (b) Alcohol

(c) Pentazocine (d) Methaqualone.

168. Most of the minor tranquilizers belong to a family of compounds called;

(a) Benzodiazepines (b) Barbiturates

(c) Amphetamines (d) Pethidines.

169. Stimulants are those drugs which stimulate the brain functions and produce Psychological Dependence only. Which one of the following is not a stimulant?

(a) Cocaine (b) Diazepam

(c) Methyl amphetamine (d) Khat

170. Hallucinogens are those drugs which produce hallucinations and other perceptual experiences. Which one of the following is not a hallucinogen?
(a) Lysergic Acid Di-ethylamide (LSD)
(b) Phenylcyclidine
(c) Bhang
(d) Mescaline

171. Cannabis is that drug which produces a rather complex effect. Which one of the following is not a preparation of cannabis?
(a) Marijuana
(b) Hashish
(c) Oxazepam
(d) Charas oil.

172. Which one of the following is a wrong pair?
(a) Opiate; Heroin
(b) Sedative; Lorazepam
(c) Stimulant; Cocaine
(d) Cannabis; Marijuana.

173. Morphine and Codeine are extracted from Opium Poppy — both have analgesic and addiction producing properties. What is their parent organic family?
(a) Carbohydrates
(b) Alkaloids
(c) Proteins
(d) Fats.

174. When was Prohibition enforced in Pakistan?
(a) February 9, 1979
(b) March 9, 1980
(a) April 9, 1978
(d) May 9, 1981.

175. Aspirin is a registered trade name of the German Bayer Company for Acetylsalicylic acid which is used as analgesic and antipyretic. When was aspirin introduced for the first time?
(a) 1890
(b) 1894
(c) 1899
(d) 1900.

176. Some people who are allergic to aspirin may safely take acetaminophen which has similar characteristics. This drug is sold under which of the following trade names.
(a) Tylenol
(b) Apamide
(c) Datril
(d) All the above.

177. Caffeine is a mild stimulant which is found in coffee beans, tea leaves and cola nuts. What is the organic family of caffeine?
(a) Carbohydrate
(b) Alkaloid
(c) Protein
(d) Fat.

178. The hectic pace of life in the modern world has driven people to seek rest and relaxation in chemicals like tranquilizers. Diazepam is a well-known tranquilizer. What is its trade name?
(a) Librium
(b) Valium
(c) Soma
(d) Reserpine.

179. A lever is a rigid bar which is capable of turning freely about a fixed point called the fulcrum. Levers are classified under three orders according to the relative positions of the fulcrum. There are several levers in the human body. Which one of the following motions in the human body belongs to the levers of the first order?
(a) Lifting one leg off the ground
(b) Raising the body on the toe.

(c) Head rocking on the atlas (d) Extending the leg.

180. Which one of the following motion illustrates levers of the second order?
- (a) Raising the forearm.
- (b) Motion of the body on the hip
- (c) Raising the body on the toe
- (d) Extending the leg

181. Which part of the tooth protrudes beyond the gum into the mouth?
- (a) Neck (b) Crown
- (c) Root (d) Fang

182. Name the teeth which are sharp, have chisel-like edges and are consequently w adapted for biting or cutting.
- (a) Incisors (b) Molars
- (c) Premolars (d) Canine

183. A child of about six years possesses teeth, called the temporary or milk teeth. Ho many they are in number?
- (a) Ten (b) Fifteen
- (c) Twenty (d) Twenty-two.

184. Which tooth is also called the dog tooth?
- (a) Canine (b) Incisor
- (c) Molar (d) Premolar.

185. In which of the following breathing acts, there is short and rapid expirations?
- (a) Yawning (c) Laughing
- (b) Sniffing (d) Coughing.

186. Which one of the following substances acts like a fuel in driving the body?
- (a) Vitamins (b) Water
- (c) Carbohydrates (d) Minerals.

187. Which of the following vitamins prevents night blindness?
- (a) Folic acid (b) Vitamin A
- (c) Vitamin C (d) Riboflavin.

188. Which one of the following diseases is more common in women than men?
- (a) Rheumatoid arthritis (b) Gastritis
- (c) Ulcer (d) Coronary thrombosis.

189. Which one of the following diseases concerns the spinal column of man?
- (a) Hypothermia (b) Cervical spondylosis
- (c) Hernia (d) Cataract.

190. What is the function of an antipyretic medicine
- (a) Reduce blood pressure (b) Cure cold
- (c) Control constipation (d) Lower fever.

191. Which one of the following is the easiest to transplant from one person to another?
- (a) Kidney (b) Heart

(c) Blood (d) Liver

192. Which one of the following treatments is administered to a person whose kidneys are not working?

(a) Blood transfusion (b) Radiotherapy

(c) Dialysis (d) Medication.

193. An analgesic is prescribed to relieve oneself of:

(a) Cough (b) Fever

(c) Pain (d) Indigestion.

194. Name the instrument used for measuring the heart-beat of a person.

(a) Sonometer (b) Stethoscope

(c) Cardiogram (d) Milometer.

195. Lymph is a modified tissue fluid which is carried by lymphatic vessels. What is the rate of lymph flow?

(a) 1-15 ml / min. (b) 2-2.5 ml /min.

(c) 0.5-1.0 ml/mm. (d) 3-35 ml /min.

196. What is the normal blood flow rate in liver?

(a) One litre per minute (b) One and a half litres per minute

(c) Two litres per minute (d) Two and a half litres per minute.

197. Which of the following carbohydrates is not digested the human body?

(a) Starch (b) Sucrose

(c) Cellulose (d) Maltose.

198. Insulin is an important hormone secreted by pancreas. It stimulates:

(a) Glycogenesis (b) Glyconeogenesis

(c) Lipogenesis (d) All the above

199. The fall in blood sugar level below its normal limits is called:

(a) Hyperglycemia (b) Hypoglycemia

(c) Glucosuria (d) Hypoglycaemia.

200. What is Agraphia?

(a) It is inability to speak (b) It is inability to write

(c) It is inability to sleep (d) It is inability to eat.

ZOOLOGY

201. Name the smallest bird in the world.

(a) Humming bird (b) Parrot

(c) Sparrow (d) Tern.

202. Spiders are also remembered by their webs which they make. Name the part of the spider from which a protein substance is secreted and is used by the spider to spin a web by which it sings, balances, drops and climbs

(a) Liver (b) Mouth

(c) Silk gland (d) Pancreas.

203. Camel is distinguished from other animals easily because of its hump. The purpose of the hump in a camel is to act as a portable storehouse of an important nutrient of food which it can use when required. What is the nature of the nutrient?

(a) Fat (b) Protein
(c) Mineral (d) Water

204. Cells are the fundamental building blocks of all living organisms. About 60 trillion cells make a human body. Human cells have different shapes, sizes and functions. What is the name of the largest cell of the human body?

(a) Muscle cell (b) Nerve cell
(c) Liver cell (d) Kidney cell.

205. Evolution is process by which living organisms have changed through time both structurally and functional. According to this doctrine higher forms have arisen out of lower forms. What is the most probable accepted sequence in which the following have been evolved?

(a) Amphibians, birds, reptiles, mammals
(b) Amphibians, reptiles, birds, mammals.
(c) Birds, amphibians, mammals, reptiles
(d) Mammals, birds, amphibians, reptiles.

206. Cell division is a process by which living cells multiply amitotic or mitotic. There are four different stages in the cell division of plants and animals. What is the correct sequence of mitotic division?

(a) Telophase, prophase, metaphase, anaphase
(b) Prophase, metaphase, anaphase, telophase.
(c) Metaphase, prophase, anaphase, telophase.
(d) Prophase, metaphase, prophase, telophase.

207 An ancient Sage said, "Man does not die, he kills himself." How can he possibly do this?

(a) By overeating (b) By not taking exercise
(c) By violating rules of nature (d) By all the above.

208. The Mesozoic Era (Prehistoric Past) is the period of time from 225 to 64 million years ago when Dinosaurs ruled the world. This period has three distinct phases Triassic period, Jurassic period and Cretaceous period. What time Jurassic period corresponds to?

(a) 200-135 million years ago (b) 225-200 million years ago.
(c) 135 million years ago (d) 100 million years ago.

209. About how-many million years ago dinosaurs became extinct reptiles?

(a) 10 million years (b) 20 million years
(c) 40 million years (d) 64 million years.

210. It is one of the twelve most endangered species of animals in the world. It lives in the Yangtze River (China) where it is threatened by pollution, fisherman and boat propellers. It is a protected animals and a national treasure. Name the animal.

(a) Spinner (b) Baiji (meaning white dolphin)

(c) Harbour propoise (d) Hectore dolphin

11. Dolphins and porpoises have developed a sense that humans and most other land animals are without it. With this sense, they can see without sound. What is this sense called?

(a) Smelling (b) Taste
(c) Echolocation (d) Speaking.

12. Friendship of dolphins with humans is a well-known legend. One such famous story was between a handsome boy of the town of lassos and a dolphin — the people of lassos were so impressed that they built a bronze statue showing a boy riding on a dolphin. Name the country where it is situated.

(a) Turkey (b) Australia
(c) Austria (d) Greek.

13. Charles Darwin was born in 1809. He was the son of Shrewsbury doctor. Having abandoned careers in medicines and the church, he joined HMS Beagle as ship's naturalist. His voyages took him all around the world and helped inspire his theories of:

(a) Reproduction (b) Evolution
(c) Mating (d) Heredity.

14. Whale, Lion, Manatee, Bat, Rabbit, Armadillo and Echidna are quite different looking animals but their bodies bear fur and they all suckle their youngs. These animals are called:

(a) Birds (b) Amphibians
(c) Mammals (d) Reptiles

15. The total number of species of Birds, living throughout the world in every sort of habitat from the seashore to the jungle are nearly:

(a) 2,000 (b) 1,000
(c) 3,000 (d) 9,000

16. Mammals are warm-blooded vertebrate animals which suckle their youngs. Name the only two mammals in the world which lay eggs.

(a) Platypus and Echinda (b) Echinda and Emu
(c) Kiwi and Kangroo (d) Koala and Emu.

17. The Amazon Jungle is a part of a huge rain forest covering much of tropical South America. Rain forests are special kinds of forests with high temperature and heavy rainfalls. Where is Amazon Jungle situated?

(a) Argentina (b) Brazil
(c) Chile (d) Peru

18. In the fossil record, the end of the Dinosaurs, alongwith more than half of the other known animals species on Earth, marks the boundary between the Cretaceous and Tertiary periods. What terms has been coined by Paleontologists for this boundary?

(a) C-T boundary (b) T-E boundary
(c) K-T boundary (d) A-E boundary.

19. The country contains the world's largest tropical rain forest, the biggest river system [illegible] nd animal life. Name the country.

(a) Mexico (b) Bolivia
(c) Equador (d) Brazil

220. There are 24 major phyla of animals encountered in the Animal Kingdom Classification Name the phylum which has the larger number of species.
(a) Chordata (b) Arthropoda
(c) Mollusca (d) Nematodes.

221. Name the largest living organism.
(a) Elephant (b) Blue whale
(c) Tree (d) Camel.

222. About how many species of animals have been characterised uptil date?
(a) One and a half million (b) Hundred thousand
(c) Ten thousand (d) Fifty thousand.

223. Malayan Tapir is an excellent swimmer. It is found in dense ram forests of Burma and Thailand, south of Malaya and Sumatra. It spends much of its time in water, cooling off, or feeding. It has a special distinct combination of colouration on the skin which serves to camouflage the tapir among the shadows in the forest for protection against predators. What is the combination of colouration.
(a) Black and red (b) White and green
(c) Black and white (d) White and blue.

224. Name the most valuable animal in cash terms:
(a) Cobra snake (b) African elephant
(c) Ostrich (d) Racing horse.

225. Name the animal which can hang upside down from branches of tree even when sleeping.
(a) The dingo (b) The sloth
(c) The jaguar (d) The chimpanzee.

226. Name the animal which remains blind for eleven weeks after its birth.
(a) Platypus (b) Armadillo
(c) Cat (d) Mouse.

227. Name the animal which has the longest gestation period (640 days).
(a) Blue whale (b) Camel
(c) African elephant (d) Rhinoceros

228. Name the bird which can fly and is the heaviest:
(a) Emu (b) Peafowl
(c) Bustar (d) Kotri Bustard

229. Name the largest member of the cat family:
(a) Siberian Tiger (b) African Lion
(c) Siberian Tiger (d) Benzal Tiger.

230. What is the maximum speed the white-throated spine tailed swift can reach?
(a) 110 Km / Hour (b) 120 Km / Hour
(c) 170 Km / Hour (d) 160 Km / Hour.

231. Name the animal which is known to have the highest known metabolic rate and it must eat increasingly to keep alive.

(a) Mouse (b) Shrew

(c) Hare (d) Mole

232. Name the bird which is the world's longest distance flier

(a) Siberian Crane (b) Arctic Term

(c) Siberian Duck (d) Alpine swift.

233. Name the animal which is immune to snake.

(a) Boar (b) Cow

(c) Eagle (d) Mongoose

234. Name the fastest moving fish in the world.

(a) Herring (b) Atlantic sailfish

(c) Gangetic Hilsa (d) Marlin

235. Which of the following primates has the most highly developed brain after man?

(a) Ape (b) Lemur

(c) Monkey (d) Chimpanzee

236. When did cockroaches infest the Earth)?

(a) 100 millions years ago (b) 200 millions years ago

(c) 250 million years ago (d) 350 million years ago.

237. Which of the following insects is more responsible for the spreading of the diseases?

(a) Cricket (b) Housefly

(c) Mosquito (d) Bug.

238. Name the fastest moving snake in the world:

(a) King Cobra (b) Russet's Viper

(c) Black Mamba (d) Indian Krait

239. Name the only animal in the world which has four horns.

(a) Elk (b) Chansingha

(c) Black Buck (d) Bharal

240. Exxon Valdez tanker spilled about 11 million gallons of crude oil into Alask's Prince William Sound on March 24, 1989 The incident took the lives of about how many birds?

(a) One hundred (b) One thousand

(c) Fifty thousands (d) Hundred thousands

241. Which of the following birds construct the biggest unit nest structure in the world?

(a) Red-billed Quelea (b) Sociable Weaver.

(c) Mountain Drongo (d) Ostrich

242. Name the longest living reptile in the world.

(a) Emerald Tree Boa (b) Reticulated Python

(c) Black Mamba (d) King Cobra

243. Name the fish which can remain out of water for the longest time.

(a) Mudskipper (b) Trout

(c) Salmon (d) Hilsa.

244. Which of the following is an endangered butterfly?

(a) Birdwing (b) Monarch

(c) Shallow-tail (d) Alexandra Birdwing.

245. Name the largest butterfly in the world.

(a) Alexandra Birdwing (b) Monarch

(c) Birdwing (d) Shallow-tail

246. ICBP is the acronym for International Council for Bird Preservation. Where is this located?

(a) Karachi (b) New York

(c) Cambridge (d) Bombay.

247. Name the author of the book "the Encyclopedia of world wildlife" published by Chartwell Books in 1986.

(a) Ian Prestt (b) H.S. Pan war

(c) Anthony (d) S. Dillon Ripley.

248. Name the world's richest biological ecosystem.

(a) Deserts (b) Tropical moist forests

(c) Wetlands (d) Grasslands

249. Name the continent which is known as the "Paradise of Big Game"?

(a) Europe (b) Africa

(c) South America (d) North America.

250. Name the country which has the highest number of deer species in the world.

(a) Pakistan (b) Zambia

(c) India (d) Bhotan

251. Golden Bamboo Lemur was discovered and identified in 1986. Name the locality of the discovery:

(a) Madagascar (b) Australia

(c) Kenya (d) Uganda.

252. Orangutan is the largest primate of the Asian Continent. Name the largest primate in the world.

(a) Pileated Gibbon (b) Red Colobus

(c) Mountain Gorilla (d) None of the above

253. Name the primate which is famous for its chest-beating display.

(a) Gibbon (b) Gorilla

(c) Golden Langur (d) Colobus.

254. There are three races of the gorilla found in the world mainly in Central Africa. What is the food habitat of the Gorilla?

(a) Carnivorous (b) Herbivorous

(c) Omnivorous (d) Capriphagous.

255. Name the mountain range where Spectacled Bear is found.

(a) Himalayas (b) Rocky

(c) Alps (d) Andes.

256. Name the only member of the cat family that does not have retractable claws.
(a) Cheetah (b) Lion
(c) Leopard (d) Tiger.

257. Koala eats Eucalyptus leaves, it is a:
(a) Snake (b) Bear
(c) Frog (d) Marsupial.

258. Name the largest marsupial in the world:
(a) Koala (b) Red Kangaroo
(c) Grey Kangroo (d) Yak.

259. Hare is a swift timid long-eared mammal. Name the largest hare in the world.
(a) Antelope Jackrabbit (b) Lynx
(c) European Beaver (d) Black-napped Hare.

260. Kangroo is a marsupial mammal. It has a long powerful hind legs, a long thick tail and small forelegs, mainly found in Australia. What is its common food?
(a) Rodents (b) Nuts
(c) Grass and plants (d) Birds.

261. Kiwi is a flightless bird, has long bill, stout legs and rudimentary wings. Where is this found?
(a) Australia (b) India
(c) Newzeland (d) Africa.

262. Name the swift-footed 2-toed flightless bird. It is the largest bird and has valuable wings and tail plumes. It is found in plains and deserts of Africa.
(a) Penguin (b) Emu
(c) Ostrich (d) Kiwi

263. Name the tropical aquatic herbivorous mammal measuring about 16 feet in length. It is found in coastal sea water and rivers of Western Africa, Southeast U.S, West Indies and South America.
(a) Manatee (b) Blue whale
(c) Tapir (d) Killer whale.

264. Name the long tailed Himalayan carnivore. It has a long black and white fur. It is found in mountains and bamboo forests of central China. It is not a bear.
(a) Jaguar (b) Walrus
(c) Panda (d) Koala

265. Name the small flat-footed aquatic mammal which has a fleshy bill, dense fur, webbed feet and by flattened Tail. It is one of the only two mammals in the world which lay eggs. It is found in Southern and Eastern Australia and Tasmania:
(a) Platypus (b) Blue Whale
(c) Walrus (d) Tapir

266. Name the marine mammal related to seals. It is hunted for the tough heavy hide and the ivory tusks. It is found in the Northern Sea.

(a) Tapir (b) Walrus
(c) Manatee (d) Platypus.

267. Name the long aquatic reptile which has a broad head and a special pocket in the upper jaw. Its tail is specially flattened for swimming and the nostril is placed high on the snout so that it can breathe even when lying partly submerged in water. It is found in lakes, swamps and rivers of Southeastern North America.

(a) Crocodile (b) Alligator
(c) Cobra (d) Rhinoceros.

268. What is Emu?

(a) Bird (c) Mammal
(b) Reptile (d) Fish

269. The offspring of a cross between a tiger and a lioness is called Tigon. What is the offspring called if we reverse the gender of the partners?

(a) Ligon (b) Liger
(c) Litigon (d) Tigon

270. Seal is a marine aquatic carnivorous mammal that occurs chiefly in cold regions. It has limbs modified into webbed flippers adapted primarily to swimming. Name the most abundant species of seal in the world.

(a) Crabeater seal (b) Elephant Seal
(c) Weddel seal (d) Leopard Seal.

271. Rhinoceros is a large powerful herbivorous thick skinned mammal. It has one or two upright horns on the snout. It is found in the savannahs of Africa. Name the smallest Rhinoceros in the World.

(a) Javan Rhino (b) Sumatran Rhino
(c) White Rhino (d) Black Rhino.

272. Dear is a small ruminant mammal. It has a two large and two small hoofs on each foot and antlers borne by the males of nearly all and by the females of a few forms. Name the largest deer in the world.

(a) Moose (b) Cheetal
(c) Hog (d) Sambhar.

273. How many species of birds are recorded uptil date?

(a) 11,006 (b) 10,006
(c) 9,006 (d) 8,006

274. Penguins are erect short-legged flightless birds found in southern hemisphere. How many species of penguins are known?

(a) 12 (b) 13
(c) 15 (d) 17

275. Emperor Penguin is the largest. Name the smallest Penguin.

(a) Little Blue Penguin (b) Adelie Penguin
(c) Peruvian Penguin (d) None of the above.

276. Pelican is a large web-footed bird with a very large bill and distensible regular pouch in which fish are caught. Name the pelican that dives from the air to catch its prey.

(a) Grey Pelican
(b) Dalmation Pelican
(c) Brown Pelican
(d) Black Pelican.

277. Ibis is a wading bird related to the herones but distinguished by a long slender downwardly curved bill. Name the most beautiful Ibis in the World.

(a) Japanese Crested Ibis
(b) Scarlet Ibis
(c) Reared Ibis
(d) Jabiru Ibis.

278. Flamingo is an aquatic bird with long legs and neck, webbed feet, a broad lamellate bill resembling that of a duck. Name the largest and most widespread species of flamingo.

(a) Andean Flamingo
(b) Greater Flamingo
(c) James Flamingo
(d) Lesser Flamingo

279. Duck is a swimming bird with small neck and legs. It has a body more or less depressed and the bill is often broad and flat. Name the species of duck which is extinct.

(a) Goosander
(b) Pink-headed
(c) Shovelbilled Pink-eared
(d) None

280. Name the national bird of U.S.A.

(a) Tawny eagle
(b) Bald eagle
(c) Golden eagle
(d) Palmut Vulture.

281. Crane is a tall wading bird superficially resembling the herons but structurally more nearly related to the rails. Name the rarest crane in the world.

(a) Japanese Crane
(b) Whooping Crane
(c) Stanley Crane
(d) Common Crane.

282. Name the bird which remained the symbol of Roman Power

(a) Golden Eagle
(b) Crowned Crane
(c) Tawny Eagle
(d) Bald Eagle.

283. Owl is a bird of prey with large head and eyes, short hooked bill, strong talons, and more or less nocturnal habits. Name the largest owl in the World.

(a) Spotted Eagle Owl
(b) Milky Eagle Owl.
(c) Bay Owl
(d) Eurasian Eagle Owl.

284. How many species of the hummingbird are to be found in the world?

(a) 300
(b) 305
(c) 315
(d) 320.

285. Name the bird which is most famous for singing.

(a) Brown-eared bulbul
(b) Indian robin
(c) Nightingale
(d) Freira.

286. Reptile is a cold-blooded creeping animal. How many species of reptiles are known?

(a) 3,000
(b) 4,000
(c) 6,000
(d) 5,000

287. Which one of the following snakes is not capable of gliding through the air?

(a) King Cobra

(b) Golden tree snake
(c) Paradise flying snake
(d) Andaman flying snake.

288. Name the largest snake in the world.
(a) King Cobra (b) Anaconda
(c) Mamba (d) Viper.

289. Where is the Anaconda mostly found?
(a) India (b) Brazil
(c) Zambia (d) Egypt.

290. Pain, immediate swelling, blisters and necrosis are the local symptoms of bite by a venomous snake. What is the nature of the main chemical constituent of the snake venom?
(a) Vitamins (b) Fats
(c) Proteins (d) Carbohydrates.

291. Turtle is a land, freshwater and marine reptile with a toothless horny peak and a bony shell. Name the largest turtle in the world.
(a) Leatherback turtle (b) Green turtle
(c) Hawksbill turtle (d) Loggerhead turtle.

292. Amphibians are the animals that can survive both on land and water. Which one of the following is not an amphibian?
(a) Frog (b) Toad
(c) Salamander (d) Lizard.

293. Chaetodon is the zoological name of butterfly fish. Why it is so named?
(a) Because it cannot swim
(b) Because it has varied colours.
(c) Because it can fly
(d) Because it has wings.

294. Alexandra Birdwing Butterfly is the largest butterfly in the World. What is its approximate wing span?
(a) 20 cm (b) 22 cm
(c) 26 cm (d) 28 cm.

295. Scorpion is an insect of arachnids order that has an elongated body and a narrow segmented tail bearing a venomous sting at the tip. About how many species of scorpions are known?
(a) 100 (b) 600
(c) 500 (d) 300.

296. Spider is an insect or arachnids order. Spiders are famous for making webs to catch prey. What is the chemical nature of the spider web?
(a) Carbohydrate (b) Fat
(c) Protein (d) Mineral

297. True dolphins belong to the family Delphinidae, which contains 31 species of dolphins. Orca is the largest member of this family. What is it also called?
(a) Killer Whale (b) Hector's dolphin
(c) Common dolphin (d) Hourglass dolphin

298. Dolphins and Porpoises need streamlined bodies to help them move quickly through the water. They have no external ears. They have developed sense that humans and most other land animals are without. It is called echolocation. This means they:
(a) See with light (b) See with shadows
(c) See with sound (d) See with air.

299. Which dolphin is considered the most friendly to humans?
(a) Bottlenose dolphin (b) Hector's dolphin
(c) Dusky dolphin (d) Spinner dolphin.

300. When dolphins balance on their tails and raise themselves up out of water to around — it is called:
(a) Vortex (b) Spy-hopping
(c) Echolocation (d) Stranding.

BOTANY

301. Name the branch of science which deals with plant kingdom.
(a) Zoology (b) Botany
(c) Ecology (d) Physiology

302. Name the branch of science which deals with both Plant and Animal Kingdoms.
(a) Biology (b) Zoology
(c) Morphology (d) Microbiology

303. Name the oldest living organisms on the surface of this Earth.
(a) Apes (b) Human beings
(c) Animals (d) Plants

304. What name is given to the trees which shed their leaves every year?
(a) Herbs (b) Deciduous
(c) Shrubs (d) Non-decidous

305. What name is given to the Bacteria which cause sore throats?
(a) Streptococcus (b) Chlorobium
(c) Clostridium (d) Spirillum

306. What is the shape of most animal Viruses?
(a) Rod-shaped (b) Spiral
(c) Spherical (d) Linear

307. Quinine is a well-known Alkaloid and it is used for the treatment of Malaria. It is obtained from Cinchona plant. Name the part of the plant from which it is extracted.
(a) Roots (b) Seeds
(c) Bark (d) Thalamus

308. Cocaine is a powerful Stimulant and" it belongs to the family of Alkaloids. It is also used as a local anesthetic agent. The drug was first isolated in 1860 from the leaves of which plant?

(a) Coca (c) Cacas
(c) Coconut (d) Cardamoms

309. Gum Arabic maintains the blood pressure because it matches the Osmotic Pressure of the blood. Name its source.

(a) Acacia Arabic (c) Acacia modesta
(c) Acacia Senegal (d) Chlorophytes

310. Xerophytes are plants of relatively Dry Habitat. What name is given to the Aquatic Plants?

(a) Heliophytes (b) Hydrophytes
(c) Malophytes (d) Hygrophytes.

311. Which part is usually absent in the Aquatic Plants?

(a) Flowers (b) Leaves
(c) Root cap (d) Roots

312. Botanical name for Flowering plants is Phanerogams. What are Non-flowering Plants called?

(a) Hemicryptogams (b) Byroghytes
(c) Cryptogams (d) None of the above.

313. Fungi are non-green plants while Algae are green plants. What they differ in having?

(a) Chlorophyl! (b) Carotenes
(c) Iron (d) Xanthophyli.

314. Most of the plants can prepare their own food through the process of Photosynthesis. Such living organisms are called:

(a) Heterotrophs (b) Autotrophs
(c) Chlorospores (d) None of the above.

315. Annuals are the plants which grow, flower and fruit and die within a year. Name the plants which live for more than two years.

(a) Evergreen (b) Perennials
(c) Dinneals (d) Twiners

316. Ferns are flowerless and seedless plants constituting a class of lower Vasular plants. Name the leaves of Ferns.

(a) Fronds (b) Blades
(c) Lamina (d) Micro sporangia

317. Gymnosperms are a class or sub-division of woody vascular seed plants. What is the nature of the seeds?

(a) Present in fruits (b) Contained within the ovule
(c) Partly naked and partly enclosed
(d) Naked.

318. Ephednne drug is an Alkaloid commonly used for relief of hay-fever, asthma and nasal congestion. From which gymnosperm plant is Ephedrine extracted?

(a) Podocarpus (b) Ginkgo biloba
(c) Ephedra nebrodenis (d) Abies pindrow

319. Bryophytes are a division of non-flowering plants comprising the mosses and liverworts. Name the predominate phase in the life-cycle of the Bryophyte.
(a) Capsula (b) Gametophyte
(c) Riccia (d) Porella

320. Shrubs are the plants which are shorter than trees in height and have bushy appearance. Name the plant; which have woody trunks and branches.
(a) Bushes (b) Trees
(c) Creepers (d) Sporophytes

321. Dendochronology is the historical analysis of the annual rings in a tree. How is the age of a tree determined?
(a) By counting number of branches
(b) By analyzing chlorophyll contents.
(c) By counting number of rings from the centre of the trunk.
(d) By counting number of flowers produced in a week.

322. Petiole is a slender stem that supports the blade of a foliage leaf. Which among the following leaves does not have the petiole?
(a) Prickly poppy (b) Rose
(c) Sunflower (d) Shoe flower

323. "Touch me not" plants have compound leaves. They have special shock movements called Seismonastic. What is the botanical name of these plants?
(a) Mimos a pundica (b) Evergreen
(c) Seedophytes (d) Chlorophytes.

324. The green colour of the leaves is due to the presence of a green pigment called chlorophyll. Name the pigments which are present in carrots and citrus fruits.
(a) Carotenes (b) Xanthophyll
(c) Phycobilins (d) None of the above.

325. Chlorophyll is an organo-metallic complex of porphynns testified with long chain alcohol phytol. Name the central atom present in the molecule of chlorophyll.
(a) Magnesium (b) Potassium
(c) Zinc (d) Copper

326. The essential parts of a Flower are Androecium and Gynoecium. When both of these parts are present then the flower is called:
(a) Asexual (b) Hermophrodite
(c) Unisexual (d) None of the above.

327. Monoecious plants bear both male and female flowers. Name the paint which bears either male or female flowers.
(a) Dioecious (b) Polygamous
(c) Bisexual (d) Polyandrous.

328. A flower is said to be regular if it can be divided into equal halves in all planes of division. Shoe flower is a typical example of a regular flower. What is the botanical name for regular flowers?

(a) Incomplete (b) Zygomorphyic

(c) Acyclic (d) Actinomorphic

329. Ovules develop into seeds after maturation. What Hevelops into fruits after Fertilization?

(a) Carpels (b) Stigma

(c) Ovary (d) Thalamus

330. Pollination is defined as the transfer of pollen grains from the Anther to the Stigma of the Gynoecium. Name the process when the pollen grains are transferred from the anther to the stigma of the same flower.

(a) Self-Fertilization (b) Self-Pollination

(c) Cross-Pollination (d) Fertilization.

331. Cross-pollination is the process in which the transfer of pollen grains takes place from the anther of one flower of one plant to the stigma of another flower of another plant. Name the agency through which cross-pollination can occur.

(a) Wind (b) Water

(c) Insects (d) All the above.

232. Below is given pairs of fruits and their edible parts. Which out of the following is a wrong pair?

(a) Banana; endocap (b) Apple; thalamus

(c) Orange; juicy hairs on endocap

(d) Lemon, epicap.

333. Below is given pairs of fruits and their Botanical names. Which out of the following is a wrong pair?

(a) Mango; drupe (b) Cucumber; lomentum

(c) Apple; pome (d) Pomegranate; balausta

334. Osmosis and Diffusion mainly control the absorption of water by the plants. By which part of the plant is water actually absorbed.

(a) Secondary roots. (b) Tertiary roots

(c) Root hairs (d) Cell wall.

335. Both plants and animals are made-up of cells. The presence of what makes the plant cells to differ from animal cells?

(a) Celulose cell walls (b) Large vacuoles

(c) Chloroplast (d) All the above.

336. Photosynthesis in plants occur at day time. What is the best time for transpiration to take place?

(a) Day time (b) Evening time

(c) Night rime (d) Day and night time.

337. Chlorophyll is a green pigment present in most of the plants. What colour of the visible spectrum is most effectively absorbed by it?

(a) Blue light
(b) Red light
(c) Yellow light
(d) Green light

338. Plants need some organic compounds in small quantities for their growth and development. Auxins are typical examples. What are these compounds called?

(a) Enzymes
(b) Vitamins
(c) Hormones
(d) Inhibitor

339. Autonomic movements are those movements which take place in plants spontaneously. Name movements which are caused by external stimuli.

(a) Induced movement
(b) Paratonic movement
(c) Tactic movement
(d) Aeronotic movement

340. Parts of the plant that derive energy necessary for the synthesis of organic compounds directly from solar radiations are called phototrophic. Some parts of the plant are positively phototrophic like stem while others can be negatively phototrophic. Name one such part.

(a) Leaves
(b) Seeds
(c) Flowers
(d) Roots.

341. Lever auxanometer is used to measure the plant growth in length. Name the instrument which is used to measure the rate of transpiration in plants.

(a) Manometer
(b) Ganong's potometer
(c) Hydrometer
(d) Photometer.

342. Sandalwood trees are famous for their scented heart wood. They act as partial root parasite and they usually grow in the company of Eucalyptus globulus plants. What is the other name for Sandalwood tree plant?

(a) Ficus elastica
(b) Ashoka
(c) Santanum album
(d) Striga.

343. Heliophytes plants grow well in light. Name some plants which can grow well even in shade.

(a) Sciophytes
(b) Lithophytes
(c) Shadophytes
(d) Halophytes

344. Plant species are called cosmopolitan if they are spread over a wide area. What name is given to species which are restricted to a small area?

(a) Tundra
(b) Wild
(c) Epidemics
(d) Endemics.

345. Atropine is an important alkaloid used in medicines as an antidote against poisons and nerve gases Citrate derivative of this compound was extensively used by American soldiers during Operation Desert Storm against Iraq. Name the plant source for Atropine.

(a) Cinchona
(b) Clove
(c) Deadly nightshade
(d) Holy basil.

346. Litmus is a blue amorphous powder. Its aqueous solution is used as chemical indication for titrations and soil testing. From which species of plants is this extracted?

(a) Piper nigrum
(b) Lichens
(c) Champa
(d) Turmeric

347. Jasmine is the national flower of Pakistan. Name the national flower of India.
(a) Daffodil
(b) Sunflower
(c) Water lily
(d) Rose.

348. Some trees are remembered for their achievements or myths. Below is given pairs of some common name, alongwith their botanical names. Which one of the following pair is not correct?
(a) Ram tree; Pithecolobium Saman
(b) Traveller's joy; Climatis Vitalba
(c) Lady of the night; Cestrum nocturnum
(d) Bleeding heart; Piper betel.

349. Rufflesia is the largest flower in the world. Name the smallest flower in the world.
(a) Duck weed
(b) Lotus
(c) Sunflower
(d) Sweet violet.

350. Wellingtonia is considered as the oldest tree in the world. What is its approximate age?
(a) 3,800 years
(b) 2,000 years
(c) 1,800 years
(d) 2,800 years.

351. James Lovelock wrote, "It is not the Earth that is fragile, it is we who are fragile. Nature has withstood catastrophes far worse than what we have delivered. Nothing we do will destroy Nature. But we can easily destroy ourselves." This statement is an example of what?
(a) Man versus nature
(b) Environmental pollution
(c) Deforestation
(d) All the above.

352. What gives green colour to grass and most of the plants?
(a) Chloroplast
(b) Chlorophyll 'a'
(c) Chlorophyll 'b'
(d) All the above.

353. The total number of species of plants found on the surface of this Earth are nearly:
(a) Ten thousand
(b) Five thousand
(c) Fifty thousand
(d) Half a million.

354. Californian. Redwood trees (Giant Sequouia trees) are the largest trees in the world. They can grow to a height of about 300 feet. Where are they found in;
(a) U.S.A.
(b) Russia
(c) China
(d) India.

355. Trees are blessings of Nature and they act as lungs for the Earth. Trees need water for growth, health and survival. About how much a fully grown decidous tree can pull water from the soil every day?
(a) One Kg
(b) One ton
(c) One gm
(d) One hundred gm.

356. Name the fastest growing tree.
(a) Oak
(b) Eucalyptus
(c) Peepal
(d) Teak

357. The longest branched tree is 550 years old banyan near Gutibayalu. It is called Thimmamma Marrimanu, and its canopy covers 5.2 acres ________ an area the size of 6.3 football fields. Name the country where this tree is situated.
(a) U.S.A.
(b) Australia
(c) India
(d) China

358. Trees are the largest living creatures. They world's biggest specimen, a California Sequoia named General Sherman, stands 274.9 feet tall and measures 82.3 feet in circumference. It grew from a seed that weighs one-six-thousandth of an ounce. Name the country where it is situated.
(a) Brazil
(b) Argentina
(c) China
(d) U.S.A.

359. The world's tallest tree is another California Sequoia, Hary Cole, measures 371 feet from base to crown — the height of a 37-storey-building. Name the country where it is situated ________
(a) India
(b) Sri Lanka
(c) Nepal
(d) U.S.A.

360. Plants need some elements in traces for their healthy growth — such elements are called micro-nutrients. Which of the following elements acts as a micronutrient in the process of electron transport in photosynthesis?
(a) Copper
(b) Lithium
(c) Zinc
(d) Sodium.

361. Potato, spinach and wheat are examples of long day plants. Which one of the following is an example of short day plant?
(a) Radish
(b) Soya-bean
(c) Tobacco
(d) All the above.

362. Plants which grow vegetatively in the first year, flower and bear fruits and die in the second year are called Biennials. Which of the following plants is biennial?
(a) Banana
(b) Pineapple
(c) Jack fruit
(d) Carrot

363. Which of the following trees grows the fastest?
(a) Mango
(b) Bamboo
(c) Palm
(d) Coconut

364. Name the Muslim Scientist who had a passion for Botany and made a thorough study of plants growing in the Mediterranean region. His famous book "The Dictionary of Medicine and Food" deals with 200 novel plants, which were not mentioned before.
(a) Ibn Al-Baitar
(b) Abu Ishaq Kindi
(c) Ibn Zuhr
(d) Abdul Latif

365. Evaporation, condensation, transpiration, respiration and combustion are the terms used in an important natural cycle of our ecosystem. Name it.

(a) The Carbon cycle
(b) The Nitrogen cycle
(c) The Water cycle
(d) The Heat cycle

366. Manure is decomposed organic matter containing valuable ingredients for plant life. It assists in better drainage of clay soils. It is extensively used as fertilizer. What is the class of this fertilizer?

(a) Natural Fertilizer
(b) Synthetic Fertilizer
(c) Micro Fertilizer
(d) None of the above.

367. Natural chewing gum is obtained from Chile tree. Name the plant, flower of which yields the saffron of commerce.

(a) Crocus sativus
(b) Sterculia urens
(c) Mesuaferrea
(d) Cinchona.

368. Wood of different trees have different textures. Name the tree which yields the heaviest wood in the world.

(a) Balsa
(b) Wax palm
(c) Black iron wood
(d) Durian.

369. There are about half a million species of plants known on the surface of this Earth. About how much specie are potentially edible plants?

(a) 30,000
(b) 40,000
(c) 60,000
(d) 80,000

370. Flowering plants are classified into Monocotyledons and Dicotyledons. The flowers of monocots are mostly dull and have no smell while Dicots flowers are usually brightly coloured and scented. The main basis for classification is that the Monocotyledons have only one cotyledon in their seed pot. How many Dicotyledons have?

(a) Three
(b) Four
(c) Two
(d) Five.

371. Respiration is the process in plants and animals which provides the energy for all other process which must continue for the organism to live. Respiration is almost the reverse of what process?

(a) Carbon cycle
(b) Photosynthesis
(c) Nitrogen cycle
(d) None of the above.

372. Reproduction can be sexual and asexual. Sexual reproduction is accomplished through internal fertilization or external fertilization. Asexual reproduction takes place through various ways. Which one of the following does not correspond to this?

(a) Budding
(b) Vegetative propagation
(c) Fragmentation
(d) Fertilization.

373. Which of the following disciplines does not relate with the studies of plants?

(a) Mycology
(b) Pomology
(c) Phycology
(d) Zoology.

374. Pomology is the study of vegetables and vegetable growing. What is Palacantology study of:
(a) Fruits and fruits growing (b) Evolution of plants
(c) Fossil plants and animals. (d) Seed and their germination.

375. Homology is the study of fungi. What is plant cytology the study of?
(a) Cell and its organelles of plants.
(b) Tissues
(c) Fossil plants (d) Viruses.

376. Physiology is the branch of Botany which deals with the function of various parts within the plant. Name the branch of botany which deals with identification, nomenclature and classification of plants.
(a) Entomology (b) Taxonomy
(c) Morphology (d) Histology

377. Histology is a branch of science which deals with organic tissues of animals and plants. What is phytogeny the study of?
(a) Bacteria (b) Evolution of plants
(c) Palms (d) Flowers and their arrangement.

378. Most of the plants contain organic pigments which describe their colours. Red pigment is called phycoerythrin. What is Blue pigment called?
(a) Lutem (b) Phycobilin
(c) Phycoeyanin (d) Xanthopyll

379. Bacteria can be classified according to their shape. Typical example of rod-shaped bacteria are Bacilli. What are spherical shaped bacteria called?
(a) Cocci (b) Spirilli
(c) Comma (d) Splerobium.

380. Nitrosomonas is the name of the bacterium which converts ammonia to nitrite. Name the bacterium which converts nitrites to nitrates.
(a) Salmonella (b) Rhizobium
(c) Nitrobacter (d) Chlorobium.

381. Boils are caused by staphylococcus bacteria. What causes sore throats?
(a) Streptococcus (b) Salmonella
(c) Spirillum (d) Chlorobium.

382. Fermentation can be brought about by Butyric acid-, Lactic acid and Acetic acid in the presence of proper bacteria. Which of the following is not involved in fermentation?
(a) Clastridium pasteurianum (b) Euglena
(c) Bacterium aceti lactici (d) Acetobacter aceti.

383. Salmonella bacterium causes typhoid Name the bacteria which can cause fatal form of food poisoning.
(a) Chlorobium (b) Clostndium botulinum
(c) Nitrobectar (d) Eug Jena

384. The Pteridophytes are mostly heterosporous and the number of generations in their life cycle is two. Name the dominant phase of their life cycle

(a) Capsule (b) Sporophyte
(c) Salvinia (d) Embryo.

385. Ephedrine is an optically active organic compound and it is used as a drug in medicine as a bronchodilator in asthma and braonchial troubles. It is extracted from a gymnosperm plant found in China. Name the plant.

(a) Sequoia gigantea (b) Podocarpus
(c) Ephedra nebrodensis (d) Ginko biloba.

386. What is the basic unit of classification among the plants?

(a) Order (b) Phylum
(c) Class (d) Species.

387. Climbing roots are found in Betel. Where are respiratory roots found in?

(a) Rhizophora (b) Sugarcane
(c) Arum (d) Banana

388. Leaves of the plants can have different shapes. Below is given some pairs of plants and their characteristic leaves. Which is a wrong pair?

(a) Peapal; heart-shaped (cordate)
(b) Banana; oblong shaped
(c) Black plum; elliptic (d) Brinjal; lyrate-shaped.

389. Leaves of the plants can be simple, complex, compound or semi-compound depending upon their compositions. Compound leaf is that which is composed of small leaf-like structures. Name a plant which has compound leaves:

(a) Touch-me-not (b) Shoe flower
(c) Mango (d) Rose.

390. Pollination in plants can be affected by various animals also like birds, bats, slugs and snails. Ornithophyly is the name given to the pollination affected by birds. Name the pollination affected by bats.

(a) Chiroptenphyly (b) Malacophyly
(c) Halophyly (d) Marinophyly.

391. Buds are condensed or undeveloped shoot in which internodes have not yet elongated. Buds which give rise to vegetative parts of the plant are called vegetative buds. What name is given to the buds which give rise to flowers?

(a) Apical buds (b) Axillary buds
(c) Floral buds (d) Leafy buds.

392. Pollen is a spore-like structure liberated from microsporangium of flowering plants. Name the instrument used to study pollen grains:

(a) Simple microscope (b) Magnifying glass
(c) Compound microscope (d) Electron microscope.

393. Insectivorous plants feed on insects. Typical famous examples are 'Venus flytrap' Sundew and Water Fleartrap. Why are insectivorous plants also called as Halophytes?

(a) Because they are marshy paints.
(b) Because they are evergreen plants.
(c) Because they are barren-land plants.
(d) Because they are acid-bog-dwelling plants.

394. Lakes act as reserviors of aquatic plants. Lakes which are shallow, rich in plants and nutrients are called Eutrophic. What name is given to the lakes which are deep, poor in plants and nutritions?

(a) Lotic (b) Oligotrophic
(c) Lentic (d) Megatrophic

395. Drought deciduous plants are woody perennials. Which of the following is a typical example of such a plant?

(a) Ocotillo (b) Stone plant
(c) Notocactus (d) Oleander.

396. Coniferous forests are evergreen lying mostly between latitudes 45°N and 70°N. Name a deciduous coniferous tree.

(a) Birch sp (b) Pinus sp
(c) Spruce sp (d) Taxus sp

397. Plants have always been a source of medicinal drugs. What is the chemical nature of these plant drugs?

(a) Steroids (b) Fungicides
(c) Alcohols (d) Alkaloids.

398. Morphine is an organic compound which has been used as a pain-killer for years. It is, however, a habit forming drug and precursor of Heroine. Therefore its sale is restricted by law. From which plant is Morphine extracted?

(a) Poppy plant (b) Cinchona plant
(c) Castor plant (d) Shoe flower plant.

399. A bunch of flowers is easily the best gift one can offer on almost all occasions. Flowers are liked for their freshness, beautiful colours and pleasing fragrances. What process in the flowers is responsible for the fragrance?

(a) Oxidation of chlorophyll
(b) Evaporation of Hydrocarbons
(c) Evaporation of ethereal oils.
(d) Evaporation of nitrogen gases.

400. Apples are rich in malic acid. Which organic acid is present in grapes?

(a) Tartaric acid (b) Oxalic acid
(c) Citric acid (d) Tannic acid.

KEY TO MCQs

1. (b)	2. (b)	3. (b)	4. (a)	5. (c)	6. (c)	7. (b)
8. (d)	9. (a)	10. (d)	11. (b)	12. (b)	13. (c)	14. (b)
15. (c)	16. (d)	17. (b)	18. (b)	19. (d)	20. (b)	21. (d)
22. (b)	23. (b)	24. (b)	25. (a)	26. (c)	27. (b)	28. (d)
29. (c)	30. (c)	31. (a)	32. (b)	33. (a)	34. (c)	35. (c)
36. (a)	37. (b)	38. (c)	39. (a)	40. (d)	41. (c)	42. (c)
43. (a)	44. (c)	45. (c)	46. (a)	47. (d)	48. (b)	49. (a)
50. (c)	51. (c)	52. (b)	53. (b)	54. (a)	55. (b)	56. (a)
57. (c)	58. (d)	59. (b)	60. (d)	61. (b)	62. (b)	63. (c)
64. (c)	65. (b)	66. (d)	67. (c)	68. (a)	69. (b)	70. (c)
71. (c)	72. (b)	73. (b)	74. (d)	75. (c)	76. (c)	77. (d)
78. (a)	79. (b)	80. (b)	81. (b)	82. (c)	83. (c)	84. (b)
85. (c)	86. (d)	87. (b)	88. (d)	89. (b)	90. (a)	91. (b)
92. (c)	93. (c)	94. (c)	95. (d)	96. (c)	97. (b)	98. (b)
99. (c)	100. (b)	101. (d)	102. (c)	103. (d)	104. (a)	105. (d)
106. (d)	107. (d)	108. (b)	109. (a)	110. (b)	111. (d)	112. (b)
113. (c)	114. (d)	115. (b)	116. (b)	117. (b)	118. (d)	119. (b)
120. (b)	121. (c)	122. (b)	123. (b)	124. (a)	125. (c)	126. (d)
127. (c)	128. (d)	129. (b)	130. (c)	131. (b)	132. (b)	133. (d)
134. (d)	135. (c)	136. (d)	137. (a)	138. (b)	139. (c)	140. (b)
141. (b)	142. (c)	143. (a)	144. (c)	145. (b)	146. (a)	147. (c)
148. (c)	149. (a)	150. (d)	151. (c)	152. (d)	153. (d)	154. (a)
155. (c)	156. (c)	157. (b)	158. (a)	159. (b)	160. (c)	161. (a)
162. (b)	163. (d)	164. (c)	165. (d)	166. (b)	167. (c)	168. (a)
169. (b)	170. (c)	171. (c)	172. (b)	173. (b)	174. (a)	175. (c)
176. (d)	177. (b)	178. (b)	179. (c)	180. (c)	181. (b)	182. (a)
183. (c)	184. (a)	185. (c)	186. (c)	187. (b)	188. (a)	189. (b)
190. (d)	191. (c)	192. (c)	193. (c)	194. (b)	195. (a)	196. (b)
197. (c)	198. (d)	199. (b)	200. (b)	201. (a)	202. (c)	203. (a)
204. (b)	205. (b)	206. (b)	207. (d)	208. (a)	209. (d)	210. (b)
211. (c)	212. (d)	213. (b)	214. (c)	215. (d)	216. (a)	217. (b)
218. (c)	219. (d)	220. (a)	221. (c)	222. (a)	223. (c)	224. (d)
225. (b)	226. (a)	227. (c)	228. (d)	229. (a)	230. (c)	231. (b)
232. (b)	233. (a)	234. (b)	235. (d)	236. (d)	237. (b)	238. (c)
239. (b)	240. (d)	241. (b)	242. (b)	243. (a)	244. (b)	245. (a)
246. (c)	247. (a)	248. (b)	249. (b)	250. (c)	251. (a)	252. (c)

253. (b)	254. (b)	255. (d)	256. (a)	257. (d)	258. (b)	259. (a)
260. (c)	261. (c)	262. (c)	263. (a)	264. (c)	265. (d)	266. (b)
267. (b)	268. (a)	269. (b)	270. (a)	271. (b)	272. (a)	273. (a)
274. (d)	275. (a)	276. (c)	277. (b)	278. (b)	279. (b)	280. (b)
281. (b)	282. (a)	283. (d)	284. (d)	285. (c)	286. (c)	287. (a)
288. (b)	289. (b)	290. (c)	291. (a)	292. (d)	293. (b)	294. (d)
295. (b)	296. (c)	297. (a)	298. (c)	299. (a)	300. (b)	301. (b)
302. (a)	303. (d)	304. (b)	305. (a)	306. (c)	307. (c)	308. (a)
309. (a)	310. (b)	311. (c)	312. (c)	313. (a)	314. (b)	315. (b)
316. (a)	317. (d)	318. (c)	319. (b)	320. (b)	321. (c)	322. (a)
323. (a)	324. (a)	325. (a)	326. (b)	327. (a)	328. (d)	329. (c)
330. (b)	331. (d)	332. (d)	333. (b)	334. (c)	335. (d)	336. (a)
337. (b)	338. (c)	339. (b)	340. (d)	341. (b)	342. (c)	343. (a)
344. (d)	345. (c)	346. (b)	347. (c)	348. (d)	349. (a)	350. (a)
351. (d)	352. (d)	353. (d)	354. (a)	355. (b)	356. (b)	357. (c)
358. (d)	359. (d)	360. (a)	361. (d)	362. (c)	363. (d)	364. (a)
365. (c)	366. (a)	367. (a)	368. (c)	369. (d)	370. (c)	371. (b)
372. (d)	373. (d)	374. (c)	375. (a)	376. (b)	377. (b)	378. (c)
379. (a)	380. (c)	381. (a)	382. (b)	383. (b)	384. (b)	385. (c)
386. (d)	387. (a)	388. (d)	389. (a)	390. (a)	391. (c)	392. (d)
393. (d)	394. (b)	395. (a)	396. (a)	397. (d)	398. (a)	399. (c)
400. (a)						

QUICK REVISION

A BRIEF ACCOUNT OF HUMAN PHYSIOLOGY

Physiology: It is the study to the functions of living beings.

Main parts of the Human Body: HEAD, TRUNK & LIMBS

Building Blocks: Cells, tissues, organs, glands.

Systems of the Body: There are 07 systems of the body.

1. **The Bony System:** skull, face, backbone, arms, legs
2. **The Muscular System:** 600 muscles, Trapezium, Biceps, Triceps
3. **The Digestive System:** mouth esophagus, stomach, intestine
4. **The Respiratory System:** larynx, trachea, lungs
5. **The Circulatory System:** arteries, capillaries, veins, heart
6. **The Excretory System:** kidneys, ureter, bladder, urethra
7. **The Nervous System:** brain, spinal cord, neurons

Secretions of the Human Body

Digestive: saliva, gastric juice, bile acids, enzymes, sodium bicarbonate

Hormones: Human growth hormone, insulin, thyroxine, cortisol etc.

Blood: Composition: Red and white cells, platelets, blood groups

Skin: Protective coating, largest organ, two layers, sweat glands.

Liver: largest gland, consists of two parts called lobes, many functions

Levers: 1st, 2nd and 3rd levers works in the body.

Eyes: cornea, iris, pupil, aquous humour, lens, retina

Binders: Ligaments, tendons, cartilages, joints

Kidneys: 02 in number, bean shaped, one million nephrons

Ears: sensing organ, 03 parts, external, middle and internal ear, internal ear in complex (03 parts)

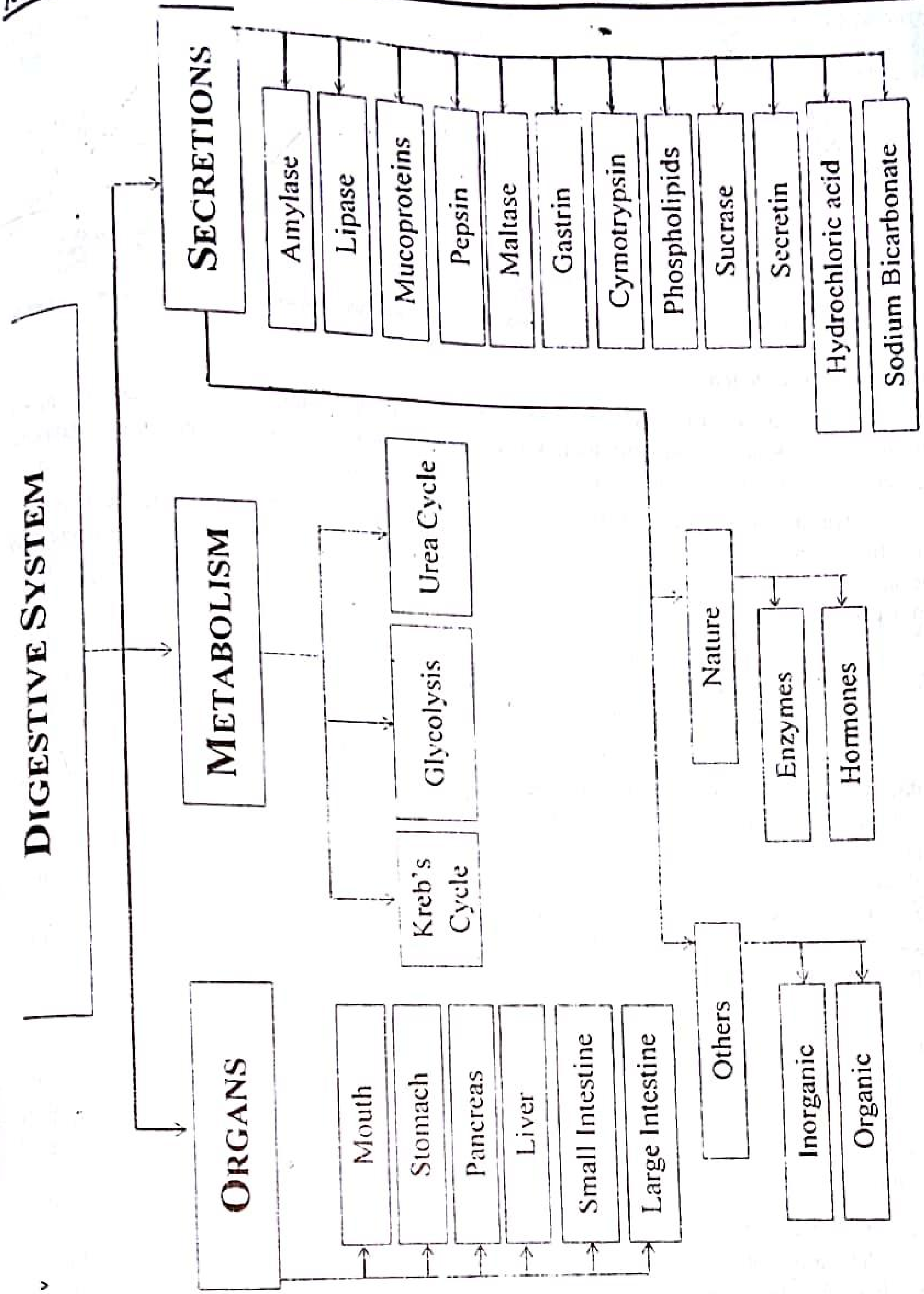
Teeth: hardest part, 32 in number, incisors (4), canines (02), biscupid (04), molar (06). Parts: crown, neck and fangs

Face: 14 – bones, upper and lower jawa, maxilla and mandible, 02 cheek bones (Molar). 02 nasal bones

Brain: nerve centre of the body, two lobes, cerebrum, cerebellum

Nails: thick horny scales of epidermis, pushed forward

Hair: outgrowth of skin, shaft and root structure


DIGESTIVE SYSTEM
ORGANS
Mouth
Stomach
Pancreas
Liver
Small Intestine
Large Intestine
METABOLISM
Kreb's Cycle
Glycolysis
Urea Cycle
SECRETIONS
Amylase
Lipase
Mucoproteins
Pepsin
Maltase
Gastrin
Cymotrypsin
Phospholipids
Sucrase
Secretin
Hydrochloric acid
Sodium Bicarbonate
Nature
Enzymes
Hormones
Others
Inorganic
Organic

CHAPTER
3

ENVIRONMENTAL SCIENCE

Environmental Science:

It is an interdisciplinary study of the complex and interconnected issues of population, resources and pollution. Environmental science involves biology, chemistry, geography, ecology and our interactions in the Environment.

Environment: Environment is a system which includes physical, chemical, organic and biological components of the Atmosphere, Biosphere, Hydrosphere, Lithosphere and oceans. All the biological and non-biological factors operate in the environment which affect an organism's life.

Eco-System: A community of organisms occupying a given region within a Biome. The physical and chemical environment of this community involves the interactions among organisms and between organisms and their environment.

Biome: It is that part of the eco-system characterized by distinctive climate, soil conditions and a similar kind of biological community (plants & animals) adopted to those conditions. Biomes are biological communities that reflect Global patterns of life. Biomes represent ecological communities delineated by climate. They occur widely across the earth and each has its characteristic structure. They are one of the world's major communities classified according to the predominant vegetation and characterized by adoptions of organisms to that particular environment. The world can be divided into major Biomes depending upon climate and abiotic factors like temperature, water, sunlight, wind, rocks and soil.

Environmental Segments

It is convenient to subdivide environmental chemistry into areas involving the chemistry of the atmosphere, hydrosphere, lithiosphere and biosphere. All matter, from minerals in the outer layers of the earth's crust to relatively stable ions in the upper reaches of the .atmosphere may be classified in one of these categories.

(1) Atmosphere

The atmosphere refers to the protective blanket of gases which are surrounding the earth It is able to sustain life on earth and saves it from the hostile environment of outer space. It is able to absorb most of the cosmic rays from outer space and a major portion of the electromagnetic radiation from the sun. It is able to transmit only near ultraviolet, visible, near infrared radiation (POO-2500 nm) and radio waves (0.10-40ju) while filtering out tissue-damaging ultraviolet radiation below about 300 nm.

The atmosphere is subdivided into different regions of varying with altitudes. The most simple division is that of the lower atmosphere extending upto approximately so kilometres above the earth's surface and the upper atmosphere, extending out into space.

The atmosphere plays a vital role in maintaining the heat balance of the earth by absorbing infrared radiation emitted by the sun and re-emitted from the earth.

The major components of the atmosphere include nitrogen and oxygen, while the minor components include argon, carbon dioxide and some trace gases.

The atmosphere has been the source of oxygen (essential for life on earth) and carbon dioxide (essential for plant photosynthesis). It also supplies nitrogen which nitrogen-fixing bacteria and ammonia-manufacturing plants use to yield chemically .bound nitrogen essential for life. Furthermore, it has been a vital carrier of water from oceans to land, as part of the hydrologic cycle.

Unfortunately, with progress in science and technology, man is dumping waste materials into the atmosphere, which pose a serious problem for survival of mankind itself on earth.

Atmospheric chemistry varies a good deal with altitude, exposure to solar radiation, pollution load and other factors.

(2) Hydrosphere

It refers to water in its various forms. It includes all types of water resources such as oceans, seas, rivers, lakes, streams, reservoirs, glaciers, polar ice caps and ground water (i.e., water below the earth's surface). For the study of environmental chemistry, however, liquid water and. the chemistry of the chemical entities therein is of predominant importance.

About 97% of the earth's water supply lies in the oceans, while the high salt content does not allow its use for human consumption, Nearly 2% of the water resource gets locked in the polar ice caps and glaciers, while only 1% is found as fresh water (surface water — rivers, lakes, streams, and ground water) for human consumption and other uses.

The history of ancient civilizations such as growth and decline has been closely linked with the quantum of water supply. The major uses of water include irrigation (30%) and thermal power plants (50%), while other uses include domestic (7%) and industrial consumption.

The contamination of surface water takes place by pesticides and fertilizers in agricultural run-off water, human and animal wastes in sewage and industrial wastes. Water-borne diseases occurring due to sewage alone have killed millions of people in many developing countries.

The basis of the aquatic environmental chemistry is a proper understanding of the sources, transport, characteristics and chemical species of water.

(3) Lithosphere

It includes the outer parts of the solid earth. In general, the term refers to minerals encarentered in the earth's crust and to the complex and variable mixture of minerals, organic matter, water and air making up soil. In so far as environmental chemistry is concerned, the soil is probably the most significant part of the lithosphere.

(4) Biosphere

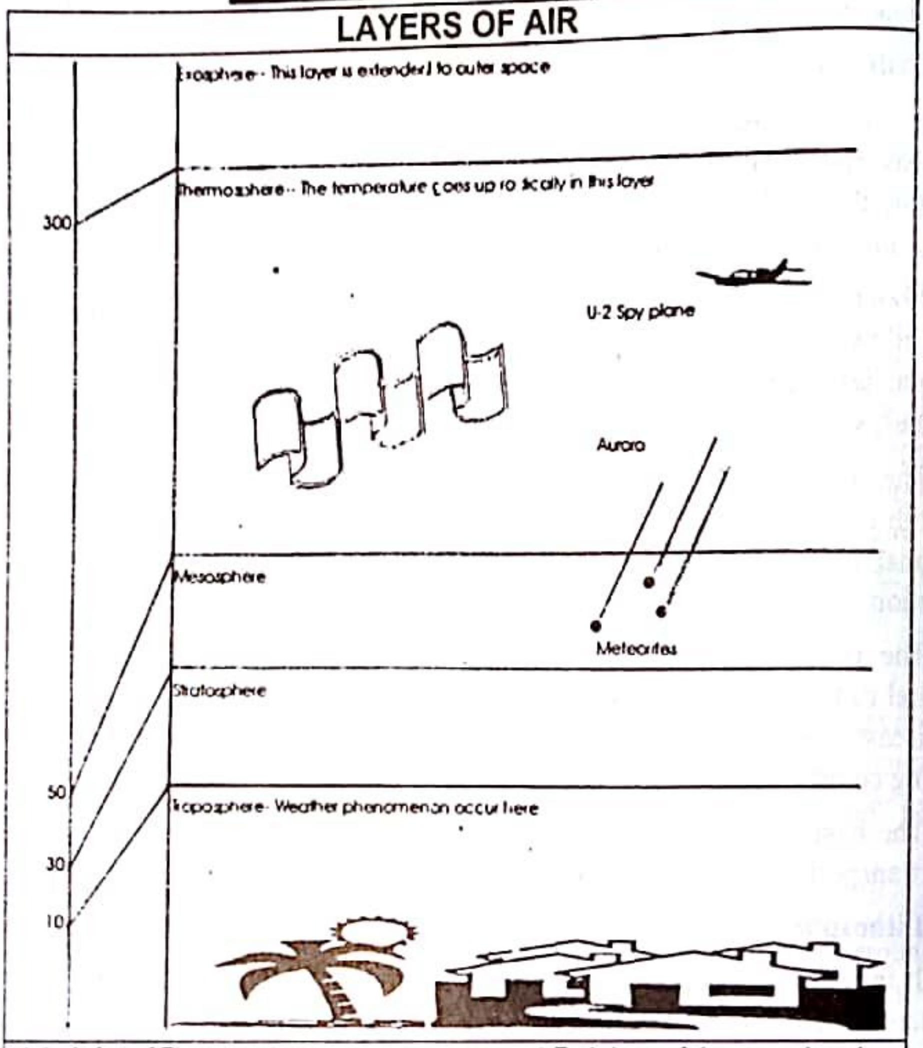
It refers to the realm of living organisms and their interactions with the environ *viz.*, atmosphere, hydrosphere and lithosphere. It includes living organisms and surroundings in which they can exist. •

The biosphere as well as environment are influenced considerably by each Thus, the oxygen and carbon dioxide levels of the atmosphere are based entirely on the kingdom. Because of the fact, green plants alone have been more or less responsible fo accumulation of oxygen in the atmosphere, through photosynthesis and decay, the ori atmosphere having been devoid of oxygen.

The biological world, in general, has been intimately related to energy flows i environment and water chemistry.

The biosphere is influenced tremendously by the chemistry of the environment a turn exerts a powerful influence upon the chemistry of most environment, especially lithosphere and hydrosphere.

EARTH'S ATMOSPHERE


LAYERS OF AIR
Exosphere - This layer is extended to outer space
Thermosphere -- The temperature goes up rapidly in this layer
300
U-2 Spy plane
Aurora
Mesosphere
Meteorites
Stratosphere
Troposphere- Weather phenomenon occur here
50
30
10

Attitude [miles] The atmosphere

▲Each layer of the atmosphere has Its own characteristics

Introduction:

The atmosphere refers to the protective blanket of gases which are surrounding the Earth. It is able to sustain life on Earth and saves it from the hostile environment of outer sphere. The atmosphere is a source of oxygen (essential for life) and carbon dioxide (essential for plant synthesis). The atmosphere also forms an insulating blanket around the Earth. Without it the temperature at the equator would rise to 120°C during the day and drop to as low as — 50 °C at night. It burns up meteors that would bombard the surface of the Earth from space. Without air, there would be no lightening, no clouds, no wind, no rain, no snow and no fire.

Origin:

It is now widely accepted that the Earth's atmosphere originally was very different from its present state and the changes were brought about by biological activity.

Composition of the Atmosphere:

The components of the atmosphere may be divided somewhat arbitrarily into major, minor and trace elements.

	Component	Percent by Volume
Major	Nitrogen	78.08
	Oxygen	20.95
Minor	Argon	0.934
	Carbon dioxide	0.033
Trace	Neon Helium Methane Hydrogen	Traces

The density of the atmosphere decreases sharply with increasing altitude as a consequence of gas laws and gravity. Over 99 percent of the total mass of the atmosphere is found within approximately 30 km of the Earth's surface. The total mass of the atmosphere is nearly 5.5×10^{15} tons. There is about 3100 cubic miles of water present in the atmosphere.

Major Regions of the Atmosphere:

The atmosphere is divided into different regions of varying with altitudes; Troposphere, Stratosphere, Mesosphere, Thermosphere and Ionosphere. The temperature may fall or rise with altitude.

Pressure of the Atmosphere:

The atmosphere exerts pressure and the average atmospheric pressure at sea level is said to be 760 mm Hg. This pressure is called Atmospheric or standard pressure. The atmospheric pressure decreases with the increase in altitude.

THE GREENHOUSE EFFECT

Earth's Thermostat

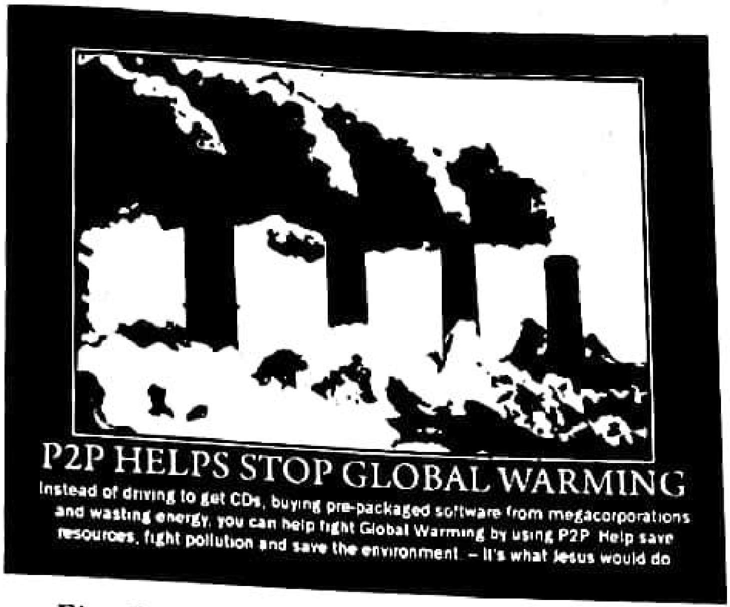
The atmosphere of the Earth can be compared to the glass of a greenhouse: both allow the Sun's visible rays to enter and warm the land, plants, water and air, yet retard the escape of heat. As radiation from the Sun enter Earth's atmosphere, a portion of it is reflected back into space or absorbed directly by the atmosphere. About half of the radiant energy reaching Earth from the Sun, because of its shorter wavelength, can pass through the atmosphere to the Earth's surface. But the longer waves of heat (Infrared radiations) that radiate back toward space are absorbed and reradiated by water vapours, carbon dioxide, other gases and clouds and hence the atmosphere warms up by chapping the heat. This is called Greenhouse Effect. The gases which contribute more towards the Greenhouse Effect are mainly carbon dioxide, methane, Nitrous Oxide and Chloro Fluoro Carbons (CFC): these gases are also called as greenhouse gases. Humans have disrupted the natural carbon cycle by burning fossil fuels for energy and by clearing forests to food and house growing populations. Industrial and agricultural emissions raise atmospheric carbon by about seven billion metric tons a year. Roughly half is absorbed by the oceans and by vegetains and soils.

GLOBAL WARMING

Greenhouse gases are building up in the atmosphere in such a way as to trap the Earth's heat, gradually raising the average temperature of the planet. If this continues, we can expect some devastating shifts in climate within next fifty years. An intensification of the greenhouse effect over the next half-century could produce average world temperature from 1.5 to 4.5 degree Celsius higher than they are today. That would induce the melting of the polar icecap and increase in the Earth's sea levels from 10 inches to five feet. Now fertile regions would he scorched into deserts, and Arctic plains could become suddenly arable. Most climate models show that in some regions — Northern Scandinavia, Siberia, and

Canada, for example — more rain would fall and more trees and crops grow. But in today's great mid-continent breadbasket regions, warming would lead to the drying of soil in summer. Destructive droughts, such as that of 1988 in North America, would strike more often until the Great Plains of Ukraine turn semi desert. Storms such as hurricanes and tornadoes might become more violent.

Forests would decline and change under the temperature rise, and wild-life would have to migrate — if it could — or perish. The permafrost Arctic tundra would thaw, deep peat lands would decompose, and vast new amounts of carbon dioxide and methane could be released.


P2P HELPS STOP GLOBAL WARMING

Instead of driving to get CDs, buying pre-packaged software from megacorporations and wasting energy, you can help fight Global Warming by using P2P. Help save resources, fight pollution and save the environment. – It's what Jesus would do

Fig: Future of Earth due to Global Warming

OZONE DEPLETION: HOLE IN THE SKY

A Crack in the Shield of Ozone Layer:

Ozone is an allotropic form of Oxygen in which there are three atoms in each molecule. It is a gas and occurs naturally in the stratosphere of "Ozone layer". This Ozone layer protects us from high-energy ultraviolet radiation of the Sun, which will otherwise kill living things. Ozone is used as a sterilizing agent in hospitals because it is disinfectant. The life could not start on the land surface of the Earth until the Ozone layer developed. Man-made chemicals are eating away at the atmosphere's Ozone layer, a crucial shield without which ultraviolet rays would cause widespread skin cancer and damage to much needed crops.

The existence of a vast **'Ozone Hole'** was noted over Antarctica in 1985, of the size of the Untied States and the depth of Mount Everest. This Antarctic hole develops every year in September and October. During that period the Ozone contents of the stratosphere over the pole diminishes by 40 percent. A continuing deterioration of the Earth's Ozone shield would expose human beings to increase ultraviolet radiation, the cause of many serious skin diseases. It will also reduce yield of many crops, especially cabbage, squash and soyabean. The main culprit for the depletion of Ozone layer is said to be Chloro Fluoro Carbons (CFC). Chloro Fluoro Carbons (CFCs) are gases, cheap and non-polluting at the ground level, and these are used to perform dozens of important functions in manufacturing and in everyday life. They are used in aerosol cans, refrigerators and air-conditioners. They are also essential ingredients in the manufacture of polyurethane foams and in cleaning tiny electric components.

ACID RAIN

Acid rain means in common language the presence of excessive acids in rain water. It has been one of the effects of air pollution. When we burn fossil fuels for energy, they produce sulphur dioxide and nitrogen dioxide gases which are highly soluble in water. During rain these oxides react with large quantities of water vapours of the atmosphere to form acids like sulphuric acid, sulphurous acid, nitric acid and nitrous acid which then return to the Earth's surface, with rain water or may remain in the atmosphere in clouds and logs.

Acid rain causes a number of adverse implications. It tends to increase acidity in the soil, threatens human and aquatic life, and destroys forests and crops reducing agricultural productivity. Acid rain also corrodes buildings, monuments statues and bridges, fences and railings. It creates a serious threat to human health also, since it contaminates not only the breathing air but also the drinking water and even food.

MAP READING

Map:

A map is drawing or representation of all or a part of the Earth's surface upon a plane sheet. Almost all geographical facts are represented by maps. The following terms and parameters are used to understand the map for the location of any place on the Earth's surface.

BIOSPHERE

The zone of Air, Land and water of the surface of the Earth that is occupied by organisms is called Biosphere. It includes all the life supporting regions of the earth and all the interactions that occur among organisms and between organisms and the environment.

Energy flows through Biosphere to all parts of the earth accessible to living organisms.

Characteristics:

1. Biosphere houses a relatively their layer consisting of seas, lakes, rivers, and streams.
2. It includes the land to soil depth of few meters.
3. An atmosphere to an attitude of a few pedometers is the aerial part of the biosphere.
4. Striking global and regional patterns exists in the distribution of organism within the Biosphere.
5. The Biosphere is a closed system like a terranism and it receives no material from outside except the sunlight.
6. If the earth were the size of an apple the biosphere would be about the thickness of its skin.
7. Although life exists throughout the biosphere, it is rare at the extremities, where conditions for survival are less than optimum.

8. The biosphere extends from the bottom of the ocean to the tops of the highest mountains.

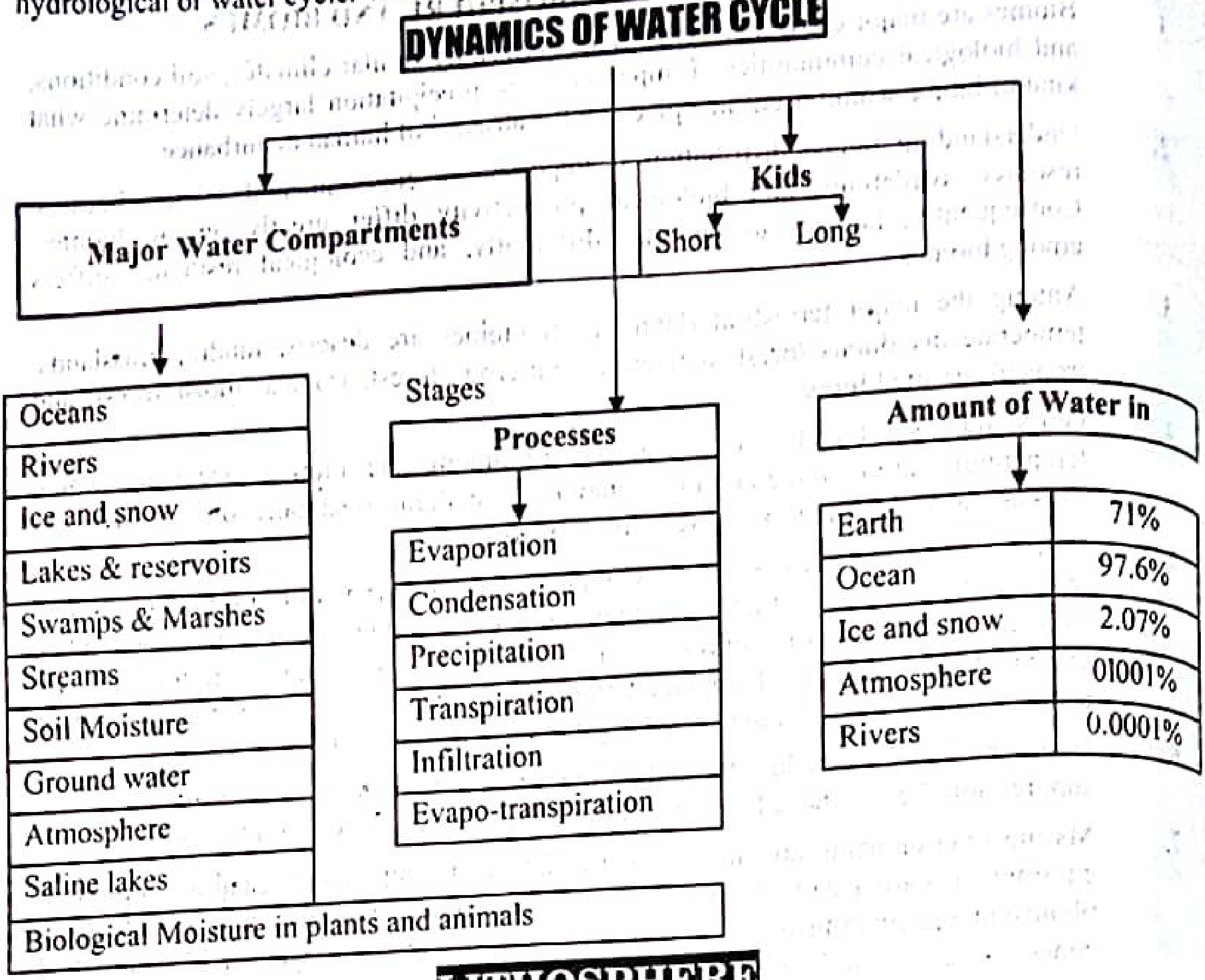
MAIN BRIEF POINTS OF BIOSPHERE AND BIOMES

1. Biomes are major ecosystem types characterized by similar climates, soil conditions, and biological communities. Temperature and precipitation largely determine what kind of biome would occur in a place, in the absence of human disturbance.
2. Understanding biome distribution is important in environmental science because resource availability and biological productivity differ greatly among biomes. Consequently, humans use biomes differently, and ecological resilience differs among biomes.
3. Among the major terrestrial (land-based) biomes are deserts, tundra, grasslands, temperate deciduous forest, temperate coniferous forest, tropical moist forest, and tropical seasonal forest.
4. Grasslands, shrublands, and savannas are among the biomes occurring where temperatures are extreme and precipitation is too slight to support forests-. Frequent fires and drought tend to keep trees from growing.
5. Forests, consisting of trees and the complex, layered communities on the ground and in the soil, occur where there is enough moisture to support trees and tree seedlings. Tropical (low-latitude) rainforests and temperate (midlalitude) rainforests are extremely tall because of abundant rainfall. Tropical forests have relatively poor soils, so cutting them removes most organic matter from the forest.
6. Grasslands have been lost through conversion to farmlands, overgrazing, and fire suppression. Forests have been lost through logging and conversion to agriculture.
7. Marine environments are influenced by light and temperature. Shallow, light-rich environments are usually the most biologically productive because they include many photosynthetic organisms. Near-shore and onshore environments include intertidal zones, estuaries, coral reefs, and mangrove swamps.
8. Marine environments play key roles in global systems because of photosynthetic activity and biomass production.
9. Freshwater aquatic systems including lakes, rivers, and wetlands, are major centers of biodiversity in terrestrial systems.
10. Wetlands provide essential ecosystem services, including floodwater storage and water purification. Even so, wetlands continue to be converted in North America and worldwide.
11. Human, alteration of ecosystems has been most extensive in forests, grasslands, and wetlands. Many islands have lost nearly all their original habitat. Arctic environments are the least directly altered by human actions, although indirect effects are extensive.

HYDROSPHERE

Introduction: It is that part of the earth and the atmosphere which contains water. It essentially consists of rivers, lakes, oceans, underground water, ponds and polar icecaps on the earth and clouds in the atmosphere. Water plays a vital role in the various physical and chemical processes upon which all life depends.

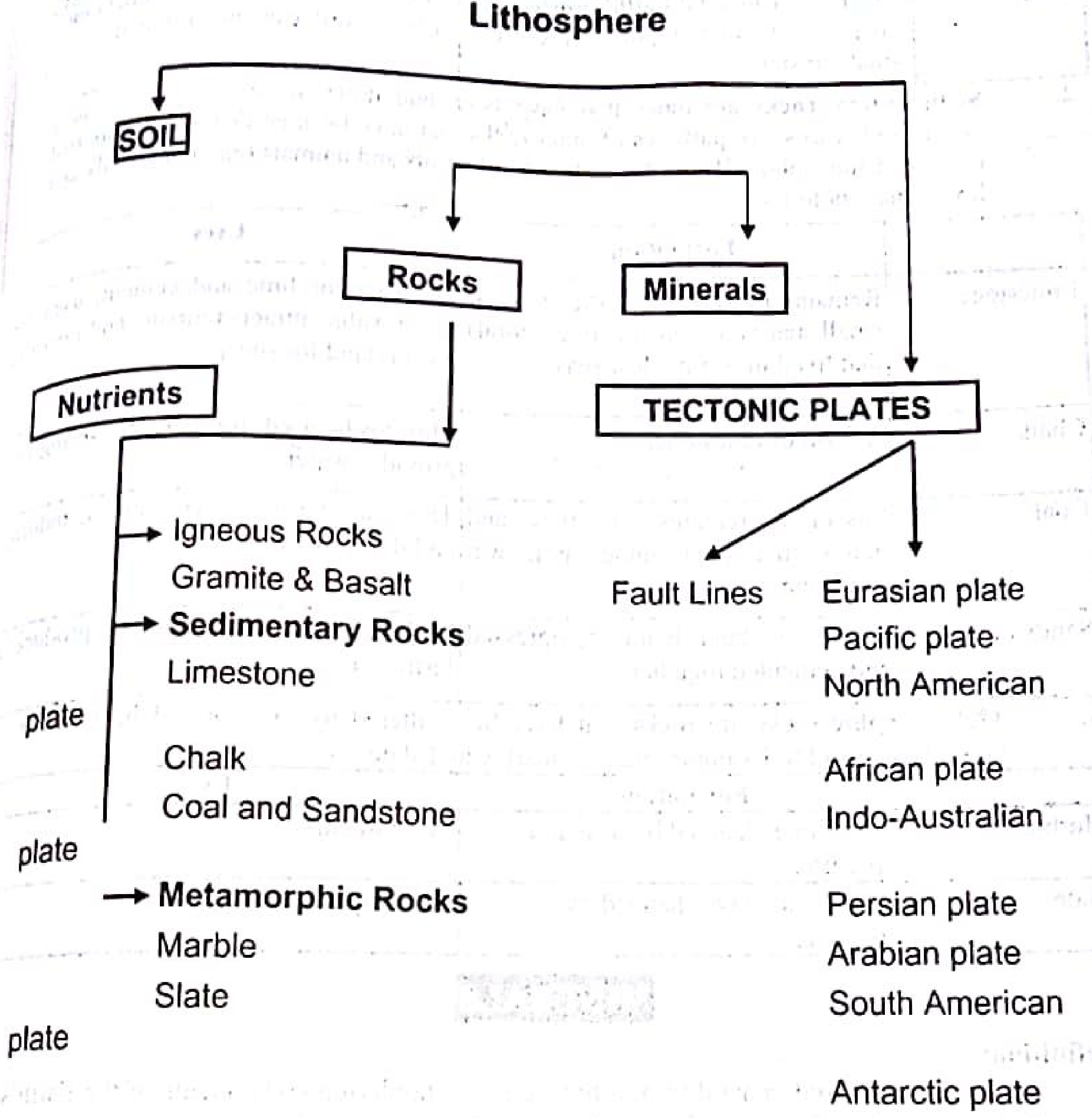
Water cycle: The continuous recycling of water between the sea, air and land driven by solar energy mainly through the processes of evaporation and precipitation is called the hydrological or water cycle. Water cycles operates in the hydrosphere.



Amount of Water in	
Earth	71%
Ocean	97.6%
Ice and snow	2.07%
Atmosphere	01001%
Rivers	0.0001%

LITHOSPHERE

Introduction: The earth essentially consists of the three main parts, the Crust, Mantle and the Core. The sold component of the earth is termed as Lithosphere which is multilayered and includes; crust, mantle and outer and inner core. The crust is very complex and its thickness is about 8 to 40 km above the mantle which extends about 200 km above the core.



Types of Rocks:

Basically there are three kinds of soil forming rocks. These are separately described below:

1. **Igneous** rocks result from volcanic activity They consist of tiny crystals which formed as the volcanic rock cooled down (photo A). Two examples are granite and basalt.

	Formation	Uses
Granite	Magma rises from the Earth's mantle and cools within the crust. The slow rate of cooling produces large crystals.	Building materials (houses and roads), sites for reservoirs, and can attract tourists.

Basalt	Magma reaches the Earth's surface as lava. As it cools rapidly, it creates small crystals.	Foundations for roads, weathers into a fertile soil, can attract tourists.

2. **Sedimentary rocks** are those that have been laid down in layers. They usually consist either of small particles of other rocks that have been eroded and transported (e.g. sandstone, photo B) or of the remains of plants and animals (e.g. coal, chalk and limestone, ohoto C).

	Formation	Uses
Limestone	Remains of shells and skeletons of small marine organisms (e.g., coral) that lived in warm, clear seas.	Quarried for lime and cement, used for stone walls, attracts tourists, and provides pastureland for sheep.
Chalk	A form of limestone.	Thin soils used for cereals, spring-line provides water.
Coal	Fossilised remains of trees and plants that grew under hot, wet conditions.	Thermal energy power stations, industry and domestic uses.
Sandstone	Grains of sand being compressed and cemented together.	Building materials and can produce a fertile soil.

3. **Metaraorphic** rocks are rocks that have been altered by extremes of heat and/or pressure (photo D). Examples include marble and slate.

	Formation	Uses
Marble	Limestone changed by heat and pressure.	Monuments.
Slate	Shales and clays changed by pressure.	Roofing materials.

MINERALS

Definition:

It is a widely used general term referring to the nonliving constituents of the Earth's crust in the crystalline form which include naturally occurring elements, compounds, and mixtures that have a definite range of chemical composition and properties. These are usually inorganic in nature. Some typical examples are Bauxite, Saprolite, Dolomite, Chromite and Gypsum. Crystallinity implies that a mineral has a definite and limited range of composition, and that the composition is expressible as a chemical formula. Almost all inorganic substances that are used by or of value to humans are derived from minerals. Over 3,000 minerals are currently known, and about 50 new discovered each year. Most gems are minerals.

Classification:

Minerals can be classified in term of structure and composition. These are classified into 13 groups, some of which are described below:

Sr. No.	GROUP OF THE MINERAL	NAME OF THE MINERAL	CHEMICAL NAME OF THE MINERAL	AVAILABILITY
1	Oxide	Bauxite	Hydrated Aluminum Oxide	Australia, France Famaica, Brazil
2.	Hydroxide	Brucite	Magnesium Hydroxide	Canada, U.S.A.
3.	Halides	Rock salt Sylvite Cryolite	Sodium Chloride Potassium chloride Sodium/Aluminum fluoride	Pakistan U.S.A., Europe U.S.A., USSR
4.	Carbonates	Limestone Marble Dolomite	Calcium Carbonate Calcium-Magnesium Carbonate	Pakistan Pakistan Pakistan
5.	Nitrates	Nitre	Potassium nitrate	U.S.A., Pakistan
6.	Borate	Borax	Sodium tetrahorate	U.S.A., Europe, Maxico
7.	Sulfates	Gypsum	Calcium Sulphate	Pakistan
8.	Tungstates	Wolframite	Calcium tungstate	U.S.A., Australia Bolivia, Europe
9.	Chromates	Chromite	Iron Chromate	USSR, Turkey, Zimbabwe

Occurrence:

Minerals result from a sequence of complex processes that began with chemical differentiation of the solar system to form planets and that ended, in many cases, with crystallization in rocks or bodies controlled by trivial local factor. The occurrence of minerals, therefore involves a general understanding of geochemistry, geophysics and peterology as well as special factors involved in the formation of ore deposits.

COMMON MINERALS WITH CHEMICAL NAME

Sr. No.	Mineral/Ore	Chemical Name	Metal Extracted
1.	Bauxite	Aluminium Hydroxide	Aluminium
2.	Beryl	Beryllium Silicate	Beryllium
3.	Brucile	Magnesium Hydroxide	Magnesium
4.	Calcite	Calcium Carbonate	Calcium
5.	Carnotite	Potassium Uranium Vanadate	Uranium
6.	Cassiterite	Stannous Oxide	Tin
7.	Carargyrite	Silver Chloride	Silver

8.	Chalcopyrite	Copper Iron Sulphate	Copper
9.	Chromite	Iron Chromium Oxide	Aluminium
10.	Cinnabar	Mercuric Sulphide	Mercury
11.	Corundum	Aluminium Oxide	Aluminium
12.	Cuprite	Copper Oxide	Copper
13.	Dolomite	Calcium Magnesium Carbonate	Magnesium
14.	Enargite	Copper Arsenic Sulphide	Copper
15.	Epsomite	Magnesium Sulphate	Magnesium
16.	Galena	Lead Sulphide	Lead
17.	Gypsum	Calcium Sulphate	Calcium
18.	Hematite	Ferric Oxide	Iron
19.	Lime Stone	Calcium Carbonate	Calcium
20.	Limonite	Ferrous Hydroxide	Iron
21.	Malachite	Copper Carbonate Hydroxide	Copper
22.	Marble	Calcium Carbonate	Calcium
23.	Pyrolusite	Manganese Dioxide	Manganese
24.	Quartz	Silicon Dioxide	Silicon
25.	Rock Salt	Sodium Chloride	Sodium
26.	Rutile	Titanium Oxide	Titanium
27.	Siderite	Iron Carbonate	Iron
28.	Sheelite	Calcium Tungstate	Tungsten
29.	Sylvite	Potassium Chloride	Potassium
30.	Wolframite	Iron Manganese Tungstate	Tungsten

Physical Properties of Minerals:

Minerals possess magnetic and electrical properties. Some of them show the phenomenon of Luminescence. Few Minerals containing Uranium and Thorium are radioactive. Most of the minerals are hard. An empirical scale of the hardness of mineral or mineral like materials originally consisting of 10 values is called the **Mohs scale.** The numerical order of increasing hardness: 1-talc, 2-gypsum, 3-Cnlcite, 4-Fluorite, 5-Apatite, 6-Orthoclase. 7-Quariz. 8-Topaz. 9-Corundum. 10-Diamond.

ATMOSPHERE POLLUTION

Air pollution is considered to be one of the most dangerous and common kind of environmental pollution reported in most industrial towns and metropolitans. Air is a mixture of gases, primarily nitrogen (78%) and oxygen (21%). It also contains small amount of carbon dioxide (0.04%) and even smaller amounts of inert substances. Suspended in the gaseous mixture is water vapor, which exists in varying amounts. Wherever you live, the air is contaminated to some degree. Smoke, haze, dust, odors, corrosive gases, noise and toxic compounds are present nearly everywhere. Total worldwide emissions of these pollutants are around 2 billion metric tons every year.

Sources of Air Pollution

(1) Natural Air Pollution:

There are many natural sources of air quality degradation. Natural events such as volcanoes, dust storms and forest fires produce large quantities of air pollution every day. Typical natural sources of air pollution are:

(i) Volcanoes:

Volcanoes spew out ash, acid mists, hydrogen sulphides and other toxic gases. Volcanic gas consists of largely steam and carbon dioxide. Some volcanic gases contains fluorine, sulphur or chlorine which are very toxic. Pyroclastic flows from the volcanic eruptions can keep the atmosphere for weeks till they settle down.

(ii) Forest fires:

Wild forest fires produce carbon monoxide, carbon dioxide nitrogen oxides and particulates which are released into the atmosphere coursing a considerable air pollution.

(iii) Wind Storms:

Wind storms send huge amount of dust in the air and such storms in arid regions raise dust clouds that transport millions of tons of soil which can be detected half a world away

(iv) Live plants:

A number of hydrocarbons involved in the air pollution are contributed by plants. Most of the hydrocarbons emitted into the atmosphere by live plants are Terpenes, namely pinene, isoprene and limonene. These volatile organic compound are responsible for the formation of Blue Haz associated with the atmosphere over some heavy growths of vegetation.

(v) Decaying plants:

Sea spray and decaying vegetation are major sources of reactive sulphur compounds in the air. Methane is formed in huge amount by bacteria in the anaerobic decomposition of decaying plants in water, rediments and soil. Bacterial metabolism of decaying vegetation in swamps and of cellulose in the guts of termites and ruminant animals is responsible for as much as two thirds of the methane in the air.

Soil: Pollen, spores, viruses, bacteria and small bits of organic material contributed by the soil into the atmosphere can course widespread suffering from allergies and airborne infections.

Sea: Salt particulates contributed by the sea into the atmosphere also cause air pollution.

Man-Made or Human-Caused Air Pollution:

Man-made or human-caused air pollution is also called as Anthropogenic air pollution. Major air pollution is caused by the human activities from the following categories:

(i) Automobiles:

Automobiles of all kinds like cars, scooters and motorcycles burn foccil fuels in the engines and they are regarded as the major sources of air pollution. They produce nearly two kinds of carbon oxide and one half of the hydrocarbons and mithous oxides. The automobile exhaust has also leaded gas and particulate lead.

(ii) Electrical power plants:

Energy in the form of electricity is produced from Electric Power plants. These power plants burn fossil fuels, particularly coal and sometimes petrol or diesel which emirts two-thirds of the sulphur dioxide in the atmosphere.

(iii) Industrial Emission:

Industrial processes like metallurgical plants, smelters, chemical plants, petroleum refineries, pulp and paper mills, sugar industries, cotton mills, rubber manufacturing plants and cement producing factories send a huge amount of toxic gases in the atmosphere.

(iv) Heating plants:

Heating plants for home, apartments, schools and industrial buildings are the fourth largest source of air pollution.

(v) Transportation:

The transportation industry including rail boards, ships, aircrafts, trucks, buses, tractors etc, have been contributing the same type of pollutants as cars.

Others:

Other sources of air pollution minor in quantities, but bear significance, due to the harmful substances which they release are Agriculture, which is responsible for pesticides. The construction industry is another minor source of air pollution.

Kinds of Pollutants:

The atmosphere contains hundreds of air pollutants from natural and anthropogenic sources. These pollutants are called **Primary Pollutants** because they are produced directly by various sources. Primary pollutants often react with one another or with water vapour. These reactions, which are often powered by energy from the sun, produce a whole new set of pollutants called the **Secondary Pollutants.** For example sulphur dioxide gas (SO_2) is a primary pollutant released from a variety of sources, such as coal-fired power plants, diesel trucks, and automobiles. In the atmosphere, sulphur dioxide gas reacts with oxygen and water to produce sulphuric acid (H_2SO_4), a highly toxic and corrosive secondary pollutant with far-reaction effects. There are five types of primary pollutants which account for more than 90% of the worldwide air pollution.

(i) Carbon monoxide

(ii) Nitrogen oxides

(iii) Sulphur Oxides

(iv) Particulates

(v) Hydrocarbons

Carbon Monoxide:

Carbon monoxide is a colourless, odourless and tasteless gas. It is 96.5% as heavy as air and it is not appreciably soluble in water. The formation of carbon monoxide is generally the result of one of the following process:

(i) Incomplete combustion of carbon or carbon containing compounds. This process takes place when the available oxygen is less than the amount required for complete combustion in which carbon dioxides is the product.

(ii) A high temperature reaction takes place between carbon dioxide and carbon-containing materials.

(iii) Partial anaerobic decomposition of organic material.

Caron monoxide inhibits respiration in animals by binding irreversibly to hemoglobin. About one billion metric tons of carbon monoxide half of that from human activities. It is also produced by internal combustion engines in transportation. Land clearing fires and cooking fires also are major sources. About 90 percent of the carbon monoxide in the air is photochemical reactions that produce ozone.

Nitrogen oxides:

There are mainly two oxides of nitrogen namely Nitric Oxide (No) and Nitrogen dioxide (NO_2) both of which are highly reactive gases usually emitted from the exhaust of the automobiles or industries. They are also formed when bacteria in soil or water oxidize nitrogen-containing compounds. Nitric oxide is a colourless and odourless gas while nitrogen dioxide is a reddish brown that gives photochemical smog in its distinctive colour. Both the gases combine with water from nitric acid which is also a major component of atmospheric acidification.

Nitric oxide is biochemically relatively inert and not very toxic while nitrogen dioxide is quite harmful to human health. Long exposure of this gas causes Bronchitis. Nitrogen oxides such as PAN formed in smog. Some textile dryer will fade away upon exposure to nitrogen dioxide. The dryer include those used on rayon cotton and viscose rayon.

Sulphur Oxides:

Air pollution from sulphur oxides consists of two colourless gaseous compounds. sulphur dioxide and sulphur trioxide. Sulphur dioxide (SO_2) has a characteristic pungent odour and does not burn in air. Sulphur trioxide (SO_3) is an extremely reactive compound the combustion of any sulphur oxides. Natural sources of sulhur containing material will produce both sulphur oxides. Natural sources of sulphur in the atmosphere include evaporation of sea spray, erosion of sulfate-containing dust from acid soils, fumes from volcanoes and fumaroles and biogenic emissions of hydrogen sulphid. Major anthropogenic source of sulphur in the atmosphere comes from the burning of coal.

The existence of sulphur trioxide in the air as a gas is possible if the concentration of water vapour is very low. When there is sufficient water vapour present in the atmosphere, SO_3, combines with water vapours to form sulphuric acid (H_2SO_4) which is highly corrosive. Sulphur dioxide present in the atmosphere is partially converted to sulphur trioxide and finally to sulphuric acid by photolytic and catalytic process. Smelters account for nearly twice the amount of any other industrial process. Acute exchange of SO_2 kill leave tissues in plants and it affects the respiratory system in humans. This gas increases the corrosion rate of most metals especially iron, steel and zinc.

GREENHOUSE GASES:

Definition: It may be defined as any naturally occurring or androgenic gas that traps heat escaping from the Earth's surface, causing the atmosphere to heat up and gives rise to Global warming which leads to Global climate change.

Examples: There are six important Greenhouse gases namely carbon dioxide, Methane, Nitrous oxide, chlorofluorocarbons, ozone and sulphur hexafluorides.

Characteristics:

(1) Greenhouse gases are transparent to visible light but absorb Infra-red (Heat) radiations emitted by the surface of the earth.

(2) Most of the greenhouse gases have considerable life span in the atmosphere.

(3) Greenhouse gases give birth to Greenhouse effect in which the gas behaves like a glass in a greenhouse.

(4) Methane absorbs 20 times a more infrared as compared to croton dioxide and its accumulation is about twice as fast a CO_2 in the atmosphere.

(5) Chlorofluro carbons are also powerful infrared absorber.

Sources: Some important sources of greenhouse gases are:

1. Burning of fossil fuels.
2. Industrial processes
3. Rudiment animals
4. Wet-rice paddies
5. Coal mines
6. Land fills

Pipeline Leakage

MAJOR GREENHOUSE GASES AND THEIR CHARACTERISTICS

Gas	Atmospheric Concentration (ppm)	Life Span (years)	Relative Greenhouse Efficiency (CO2=1)	Current Greenhouse Contribution (%)
Carbon Dioxide	380	2-4	1	64
Methane	1.774	11	25	19
Chlorofluorocarbons	0.000225	75-110	15,000	11
Nitrous oxide	0.319	150	230	6

Chlorofluorocarbons:

Chlorofluorocarbons are powerful infrared absorbers. Although CFC releases have declined since many of their uses were banned but the CFC's already present in the atmosphere will persist for many years.

Particulates:

Small solid particles and liquid droplets suspended in the gaseous medium are collectively called as particulates in the air and thy cause serious pollution problems. Particulate include dust, ash, soot, lint, smoke, pollen, spores, algal cells and many other suspended materials. Particulates often are the most apparent form of air pollution since they reduce visibility and leave dirty deposits on windows, pointed surfaces and textiles. Diesel fumes are also highly toxic because they contain both fine particulates and chemicals such as benzene, dioxins and mercury.

Respirable particles smaller than 2.5 micrometers are among the most dangerous of this group because they can be drawn into the lungs, where they damage respiratory tissues. Asbestos fib and cigarette smoke are among the most undesirable separable particles in urban and indoor air because they are carcinogenic. The size, surface area and optical properties of the particulates are important elements of the particulates towards air pollution. In general particulates affect humans, plants and materials alike.

Hydrocarbons:

Hydrocarbons are organic compounds consisting of hydrogen and carbon. They are generally voratile in nature. These organic particulates are found in a wide variety of compounds in the atmosphere. Plants are the largest source of volatile organic compounds as they release terpenes in the atmosphere. In addition to these natural hydrocarbons a large number of other synthetic organic chemicals, such as benzene, toluene and polynuclear cyclic compounds are emitted by the human activities. A significant portion of organic particulate matter comes from the exhaust of the automobiles which contains polymerized hydrocarbons. High molecular weight hydrocarbons found in the atmosphere are called hazardous air pollutants as they are carcinogenic. Hydrocarbons affect both animals and plants. Hydrocarbons entering in the atmosphere as primary pollutants produce photochemical oxidants as secondary pollutants which have undesirable effects like eye and respiratory tract irritation.

Effect of Air Pollution

Air pollution causes extraordinary environmental and economic damage worldwide. It adversely affects human health, damages the environment and the organism that live in it. I also damages buildings and a wide assortment of materials. It can be discussed under th following three headings:

(i) Air Pollution Effects on Human Health:

Air pollution has a variety of health effects, ranging from immediate to delayed ar from slight irritation to potentially life-threatening conditions. The most common route exposure to air pollution is by INHALATION, but direct absorption through the skin contamination of food and water are also important pathways.

Air pollution causes many immediate effects, such as shortness of breath, irritation, or upper respiratory tract irritation. Long term exposure to air pollution may re in a number of diseases,.including Bronchitis, Emphysema, Asthama, and lung cancer. Few serious health effects are specifically described below:

(a) Strong oxidizing pollutants like oxides of nitrogen and sulphur alongwith ozone damage delicate tissues in the eyes and respiratory passages.

(b) Carbon monoxide binds to hemoglobin of the blood and decreases the ability of the red blood cells to carry oxygen. This causes headaches, dizziness and heart stress.

(c) Lead also binds to hemoglobin and reduces oxygen-carrying ability to high levels and causes physical impairment and developmental retardation.

(d) Long term exposure to oxides of sulphur present in the atmosphere may lead to Bronchitis. It is a persistent inflammation of branchi and ronchides; small and large airways in the lungs.

(e) Sort and fine particulate material from diesel engine, wood stoves, power plant and other compaction sources have been linked to asthma, heart attacks and a variety of other diseases.

(f) Aromatic hydrocarbon present in the air are a source of irritation to the mucus membranes and leads to systemic injury in the human body.

(ii) Effects on Plants and Animals

Air pollution adversely affects plants animals and their habitat. Fumes from furnaces, smelters, refineries and chemical plants destroy vegetation and create desolate barren landscapes around mining and manufacturing centers. Some notable effects f air pollution on plants and animals can be summed up as follows:

(a) Fluoride and arsenic released from smelters can seriously poison cattle-grazing downward.

(b) Ozone, sulphur dioxide and sulphuric acid are the pollutants, most hazardous to plants. Sulphur dioxide damages plants directly causing spotting of leaves.

(c) Licenseare extremely sensitive to air pollution as they take nourishment from the air, rain and snow.

(d) Acid rain produces aquatic effect effects. Acidification of the water due to acid rain disturbs the food chain by killing aquatic plants, insects and invertebrates on which fish depend for food.

(iii) Effects on Materials:

Air pollution severely damages metals, building materials, pain, textiles, plastics, rubber, leather, clothing and ceramics

(a) Sulphur dioxide, hydrogen sulphide and particulates, damage metals by corrosion or tarnishing of surfaces. It decreases the internal strength of the metals.

(b) Stone and concrete materials are discoloured, eroded and leached out by the oxides of sulphur.

(c) Surface of the ceramic material is altered by hydrogen fluoride and the particulates.

(d) Rubber materials are weakened and cracked by ozone and other petrochemical oxidants.

(e) Leather, paper and textile materials are affected by oxides of sulphur and nitrogen.

MANAGEMENT FOR AIR POLLUTION

Pollution prevention is a key element of a sustainable society. Pollution prevention results from thing measures that promote conservation (frugality and efficiency), recycling, renewable resource use and restoration of habitats. Air pollution can be decreased by maintaining the following:

(i) Source Reduction

The cheapest and most effective way to reduce pollution is usually to avoided producing it or releasing it to the environment in the first place. Dilution is the solution to pollution is still one of the early approaches to air pollution control. Since most air pollution in the developed world is associated with transportation and energy production, the most effective strategy would be conservation.

Particulates can be removed by using grant air filters in the industries oxides o sulphur can be controlled from switching over to high sulphur coal to lower sulphur coal for energy production. Sulphur can also be removed from the atmosphere to yield a usable product instead of a waste disposal problem.

(ii) By Using modern technologies:

Many efforts to control pollution have relied on end-of-pipe solutions, mostly pollution control devices that capture pollutants or convert them into less harmful substances. Clean coal technologies and being used in the combustion processes to control pollution.

TERMS USED IN POLLUTION

Mist:	Water is the form of particles floating or falling in the atmosphere or near the surface of the earth and approaching to form rain. It is like a film before the eyes.
Haze:	Fine dust, smoke or light vapours causing lack of transparency. A finely divided liquid in a gas produces Haze.
Fog:	Vapours condensed to form fine particles of water in the lower atmosphere. It is different from clouds. Fong is thicker then Mist.
Smoke:	The gaseous products of burning carbonaceous materials made visible by the small particles of Carbon. It is a suspension of particles in the air.
Smog:	A fog made heavier and darker by smoke and chemical fumes. A grayish haze resulting by the combination of smoke and fog found in the lower atmosphere over the industrial cities. It is produced by the man-made air pollution in urban areas.

Photochemical Smog: It is a complex mixture of photochemical oxidants and nitrogen oxides usually brownish-orange in colour.

London Vs Los Angeles Smog:

London type smog caused by industrial and household fuel combustion (coal, petroleum) consisting of sulphur oxides and particulate matter is referred classical smog. While the smog formed through chemical reactions involving sunlight consisting of ozone, nitrogen oxides, hydrocarbons, smog carbon monoxide and free radicals is called Loss Angeles Photochemical smog.

KYOTO PROTOCOL to the United Nations Framework Convention on Climate change.

Introduction: The Kyoto Protocol is an international treaty, which extends the 1992 United Nations Framework Convention on climate change (UNFCC) that commits state parties to reduce the emission of greenhouse gases which has caused Global warming. It was formally in Kyoto on 11 December 1997 and entered into force on 16 February 2005.

Chronology of the Kyoto Protocol	
1992	First Session of the United Nations Framework convention on climate.
1997	Third Session of the conference of the Parties to the 1992 UN Framework convention on climate change. The protocol was formally adopted.
1998 to 1999	Open for Signatures by States and Regional Economic Integration organizations which are parties to the convention.
Feb. 2005	Entry into force of the Kyoto Protocol.
2008 2012	Start of the commitment period of the protocol. End of the commitment period of the protocol Canada with new effective December, 2007.
2014	Meeting at Lima to agree on a post-Kyoto legal Framework that would oldiagate all major polluters to pay for cozemmissions.

Status:	Signatures	83
	Current Total Parties	192

Registration: 16 February 2005, No. 30822

Main Objectives of the Kyoto Protocol

(1) The main goal of the Kyoto Protocol is to contain emissions of the main anthropogenic greenhouse gases in ways that reflect underlying national differences in GHG emissions, wealth, and capacity to make the reductions.

(2) Stabilization of greenhouse gas concentrations in the atmosphere at a level that would stop dangerous anthropogenic interference with the climate system.

(3) CO_2 is the most important greenhouse gas to be taken care of.

(4) Binding commitments for the participating parties.

(5) Parties are required to prepare policies and measures for the implementation of the reduction of greenhouse gases in their respective countries.

(6) They are required to increase the absorption of these gases and utilize all mechanisms available, such as joint implementation, the clean development mechanism and emissions trading.

(7) Minimizing impacts on Developing countries by establishing an adoption fund for climate change.

(8) Establishing a compliance committee to enforce compliance with the commitments under the Protocol.

MONTREAL PROTOCOL
FOR THE PROTECTION OF OZONE LAYER

Introduction: Montreal Protocol, formally called Montreal Protocol on substances that Deplete the ozone Layer, is an international treaty, adopted in Montreal on Sept. 16, 1987. It is aimed to regulate the production and use of chemicals that contribute to the depletion of Earth's ozone layer.

Concept: Man-made Chlorines, primarily chlorofluorocarbons (CFCs), contribute to the thinning of the ozone layer and allow larger quantities of harmful ultraviolet rays to reach the earth.

Entry into force: The protocol went into effect on Jan. 1, 1989. Initially signed by 46 countries, the treaty now has nearly 200 signatories.

Chronology of the Montreal Protocol:

1985	Vienna Convention
1987	Protocol adopted
1989	Enforced
1990	London Amendment
1992	Copenhagen Amendment
1995	Vienna Amendment
1997	Montreal Amendment
1999	Beijing Amendment

OBJECTIVES:

(1) Phasing out of ozone depleting substances

(2) Phase-out schedules differ between developed and developing countries total phase-out will be by 2040.

(3) Phase-out time is different for different substances.

Check-out List for Ozone Depleting Substances

(1) **Chlorofluorocarbons (CFCs)**

Freons is a brand name given by Du Pont, the major manufacture of CFCs which are actually he following chlorine containing compounds.

F	Category	Chemical Formula	Chemical Name
R	F-11	CCl_3F	Trichlorofluro methane
E	F-12	CCl_2F_2	Dischlorodfluro methane
O	F-22	$CHC\ell F_2$	Chlorofluoromethane
N	F-113	$C2Cl_3F_3$	Trichlow-trifluow ethane
S			

Life spans for F-11 and F-12 are 75 and 110 years respectively

2. **Halons**
3. **Carbon tetrachloride**
4. **Methyl Chloroforms**
5. **Methyl Bromide**
6. **Hydrobromofluro Carbons**

Destruction of Ozone:

Different chemical reactions between the O_3 and the above-mentioned ozone depleting substances in which the ozone is decomposed to oxygen and the overall effect is

$$\boxed{\text{Ozone } 2O_3 \xrightarrow{CFCs} 3O_2 \text{ (Oxygen)}}$$

WATER POLLUTION

"If there is magic in the planet, it is WATER"

"Loren Eiseley"

Water covers 70% of the Earth's surface and makes up two kinds or more of the weight of the most animals and upto 95% of the weight of plants. It plays an important role in the metropolis, the chemical reactions in the cells of the bodies of all organisms. It is vital to agriculture and industry, too. Despite its crucial role in our lives, water is one of the most badly abused recourses.

The term water pollution is referred to the addition to water of an excess of material (or heat) that it is harmful strictly speaking, pollution of water means departure from panty.

Types of water Pollution:

There are three types of water pollution.

(1) Surface Water Pollution:

Clean water is a national as well as global priority. Any physical, biological or chemical change in water quality that adversely affects living organisms or makes water unsuitable for derived uses is usually considered as water pollution surface water pollution is of three kinds namely:

Domestic, Industrial and Agricultural

Waste water released from municipalities include detergents, pesticides and other organic chemicals. These compounds create a problem as they are not readily broken down by bacterial action and has a long residence time. Even in low concentrations, it can cause water to form foam when such a material enters either marine or fresh water systems it increases water pollution. Unsatisfactory sanitation in urban areas is another important factor for the surface water pollution.

Waste water released from industries contains organic, inorganic, pathogens and other toxic materials which enter into rivers and lakes thereby increasing surface water pollution. Concentrated livestock production and agricultural runoff, threaten not only the underground water but also surface water systems.

(2) Oceanic Water Pollution:

The oceans are polluted by chemicals spilled into them directly and by pollutants washed from the lands and transported to them by rivers. There are five crucial challenges which malignly contribute to the oceanic water pollution.

(i) Oil Spillage pollution

(ii) Plastic Pollution

(iii) Medical wastes

(iv) Red tide

(v) Disposal of Sewage in the ocean.

Few coastlines in the world remain uncontaminated by oil or oil products. Oceanographers estimate that somewhere between 3 million and 6 million metric tons of oil are discharged into the world's ocean each year from both land and sea-base operations huge oil spills pose a threat to coastlines, coastal wetlands, fish and wildlife. Discarded plastic material are lightweight and non-biodegradable. They are carried thousands of miles on ocean currents and last for years. Even the most remote beaches of distant islands are likely to have bits of polystyrene foam containers or polyethylene packing material that were discarded half a world away. Suffocating and sometimes poisonous blooms of alga regularly deplete ocean waters of oxygen and kill enormous numbers fish and other marine life.

(3) Groundwater Pollution:

Groundwater countries to remain an important source of drinking water in many nations and it may be heavily contaminated by industrial waste, pits, tanks, oil wells and land-fills. Groundwater in some rural areas may also be contaminated by agricultural chemicals like pesticides and fertilizers. Domestic supplies of water mainly come from groundwater. Many pollutants are present at much higher concentrations in groundwater than they are present in most contaminated water supplies. Moreover many contaminates are tasteless and drugless at concentrations though to threaten human health. The most common pollutants in ground water are chlorides, nitrates, heavy metals, toxic organics and petroleum products. Some low molecular weight organic compounds are also present in the groundwater at some place and many of them have places and many of them have been found to be carcinogenic (cancer causing).

Groundwater is hard to monitor and clean as it moves slowly and takes many years to clean itself. Moreover detecting groundwater pollution is expensive and time consuming. Preventing groundwater pollution seems to be the cheapest way to protect this vital resource and is an essential element in creating a sustainable water supply system. New techniques are being developed to use naturally occurring bacteria in soil and groundwater to clean up some contamination through the process called Bioremediation.

SOURCES OF POLLUTION

Like air pollutants, water pollutants come from natural and anthropogenic (human). Volcanic eruptions, earthquakes and floods are common natural sources of water pollution. Water pollutants coming from natural and human sources travel freely from one location to another through rivers, streams and groundwater. They are also transported from one medium (land or air) to another (water).

Anthropogenic sources:

Human water pollution sources may be Point and Non-point sources. Water pollution arising from identifiable sources like factories, power plants, mines, oil wells and sewage treatment plants release tones of potentially toxic chemicals into sewers, lakes and rivers. These are called point sources because they are discrete locations, and these are relatively easy to identify and control. Scientists have come to realize that point sources are only half of the problem. The other half is the non-point sources of water pollution like less discrete sites such as forms, forests, lawns and urban streets. Rainwater washes pollutants from these sources into nearby streams, rivers and lakes.

Points and non-point sources together can result in huge problems. Non-point sources release nearly two-thirds of the pollutants in the developed countries that end up in our waterways. These substances usually include dust sediment, pesticides asbestos, fertilizers, heavy metals, salts, oil, grease, litter and even air pollutants washed from the sky by rain.

Sources of contaminating of water pollution can be put into the following major categories:

1. **Domestic Pollution**
2. **Industrial Water pollution**
3. **Agriculture Water pollution**
4. **Solid waste Pollution**
5. **Thermal Pollution**
6. **Shipping Water Pollution**
7. **Radioactive Waste Pollution.**

CAUSES OF WATER POLLUTION

Water pollution is caused by a variety of water pollutants which can be classified into the following categories:

Classification of water pollutants:

(1) Organic Chemicals:

Large quantities of organic chemicals are released into surface water form point sources such as feedlots, sewage treatment plants and various industries like paper-mills and meat producing plants. Organic pollutants also come from human sewage and animal waters. Raw sewage often enters water without treatment organic pollutants are consumed by naturally occurring bacteria. As bacteria consume to the organic malted, they help to purify the water and therefore become a part of organic pollutants by bacteria utilizes oxygen, which is dissolved in water. Excess organic a result, fish and other aquatic organisms, may perish.

Organic materials are also called as oxygen-demanding wastes

Oxygen demanding wastes are primarily organic materials that are oxidized by bacteria to carbon dioxide and water. Sewage and other oxygen demanding wastes have been classified as water pollutants because their degradation leads to oxygen depletion which affects and even kills fish and other aquatic life.

(2) Disease-causing Agents

Water acts as a potential carrier of pathogenic micro-organisms and can endanger health and life. The pathogens most frequently transmitted though water have been those responsible for infections of the intestinal tract causing typhoid, dysentery and cholera. The responsible organisms are present in the faces or urine infected people and are ultimately discharged into a water supply.

Waste water released form municipalities, sanitaria, tanning and slaughtering plants may be sources of bacteria or other micro-organisms which are capable of producing disease in men and animals, including livestock. There are several types of human infection, not all of which are transmissible through water. Many of the diseases whose epidemics recurrently decimate human populations get transmitted by water, however, cholera and typhoid being important examples.

Plant Nutrients

Inorganic nutrients are chemical compounds produced by a variety of sources, many of which also release organic nutrient. Two of the most common nutrients are nitrogen and phosphorous. These inorganic nutrients stimulate excess plant growth, which impairs navigation and swimming and disrupts the aquatic-environment. When the plants die, they decompose, causing levels to decline precipitously—an effect that can be harmful to a host of organisms.

The accumulation of nutrients of organisms from both natural and human sources is called natural and cultural Eutrophication, respectively. Combined with the deposition of rudiment from human activities, cultural euthesphication causes lakes to age prematurely.

Sediments

Sediments are soil and mineral particles which are washed from the land by storms and floodwaters, from croplands, unprotected forest soils, overgrazed urban areas. Sediments are able to fill stream channels and reservoirs, erode power turbines and pumping equipment; reduce the amount of sunlight available to green aquatic plants; plug water filters; and blanket fish nests, spawn, and food supplies, thus reducing the fish and shellfish populations. Sediments cause water pollution because of the naturally occurring of erosion.

Radioactive Materials:

Harmful radiation may result in water environments from the wastes of uranium and thorium mining and refining, from nuclear power plants. This may also be caused by from industrial, medical and scientific utilization of radioactive materials. Many radioactive substances are lethal at relatively low concentrations and in minaret amounts may be mutagenic.

Perhaps the greatest problem of radioactive pollution, as result of uranium production, has been cause by the large quantities of Uranium tailings produced. This finely divided solid material is left behind one the useful materials have been leached out. Huge piles of these tailing are found in uranium producing areas. These tailing produces pollution problem as they contain radioactive decay products of uranium.

Thermal Pollution

Heat is not ordinarily thought of as a pollutants by many people, at least not in the same sense as a corrosive material. Rapid or even gradual changes in water temperature can disrupt aquatic ecosystem with profound effects. Power plants and factories must use water to cool liquids or machinery. Small amounts of heat have no serious effect on the aquatic each system, but large quantities of heat can shift conditions beyond the range of tolerance of aquatic organisms.

Thermal pollution also lowers the dissolved oxygen content of water, at the sam time increasing the metabolic rate of fish and aquatic organisms. Metabolism consists of th chemical reactions occurring in the cells of organisms. As the metabolism requires oxygen, some species may be eliminated entirely if the water temperature rises by 10C.

Sudden changes in water temperature can cause thermal shock; the sudden cannot escape into collar neighboring waters. Thermal shocks are frequently experienced when power plants begin operation or when they are temporary shut down for repair. The later event can devastate heat tolerant species that inhibit artificially warmed waters water temperature also influences the survival and early development of aquatic organisms.

Thermal pollution can be controlled by constructing ponds for collecting and cooling water before it is released cooling towers are another way to dissipate heat.

Heavy metals toxicity

Heavy metals are the elements of the periodic table which has high atomic mass. Mercury, Lead, Arsenic and Selenium are those heavy metals which cause water pollution.

Mercury:

Mercury compounds like many others are dispersed throughout rocks, soil, air, water and living organisms by a complex system of physical, chemical and biological processes. The largest user of mercury has been seen to be they chlor-alkali industry which produces chlorine and caustic soda by the electrolysis of Sodium chloride solution. Phenyl mercuric acetate is being used in papa and pulp industry. Agricultural industries have been using organomercury compounds as seed dressings to inhabit the growth of fungi on agricultural seeds. The other sources are such commonly materials as disinfectants, pharmaceuticals and paints.

All mercury compounds have been toxic to the body when present in sufficient quantity. Ingorganic mercury tends to accumulate in liver and kidney tissue. Metallic mercury vapours have a great capacity for diffusion through the lungs into the blood and then into the brain where serious central nervous system damage takes place.

Lead:

Lead pollution occurs in air, water and soil. The production of lead strong quantity of lead. Pure lead finds use in pipe designed to carry corrosive materials and as a covering for electrical cables used underground or under water. High levels of lead and found in waters located near of water born lead pollution comes from the use of lead pipes in interior and extension plumberig. Organic lead compounds by the body though the skin or mucous membrane. Lead is a cumulative poison. About 90% of the lead retained in the body enters the bones, form when it can be remobilized.

Arsenic:

Methyl, arsenic compounds occur in several water bodies in Aubstantial percentages. Arsenic is a deadly poison and it is being used as a rodenticide and wed killer. Arsenic is found in the groundwater near industries. Symptoms of lead poisoning include watery and implamed eyes, gastrointestinal cramps, gradual loss of strength and eventually death.

LAND POLLUTION

Introduction:

The surface of the earth contains oceans, seas, rivers, leaks, ponds and solid land surface. Solid land occupies about 30% of the total surface area. Land pollution is an important kind pollution and it arises from the solid wastes given out by home, farms, factories and power plants. The nature of the solid waste its management and disposal are important parts of Land Pollution which affects human beings in the same manner as does the Air pollution and water pollution.

Solid Waste:

We all produce solid wastes in nearly everything we do and it is everybody's concern to manage it and deposited off properly for a healthy life in our community. Billion tons of solid wastes is produced every year in all parts of the world. There are nearly three kinds of solid wastes namely:

(1) Domestic or Municipal Solid Waste:

Every year, human society produces mountains of municipal solid wastes like:

DISCARDED PAPER AND PAPER BOARD
LEFTOVER FOOD WASTES
BROKEN WOODS
PLASTICS
GLASS
METALS
YARD WASTES
TEXTILES
RUBBER & LEATHER
OTHER ITEMS

All these items come from hospitals, schools, stores, airports and homes. The problems are especially acute in the mere developed nations. Americans produced about 246 million tons of municipal solid waste in the year 005. On a more individual level, about 727 kilograms were produced per person over 2 kilograms per person per day. Although solid waste management is using modern methods for its disposal but huge amounts of this waste continue to remain a threat to land pollution. Municipal solid waste is the product of many interacting factors.

(1) Large populations
(2) High per capita consumption
(3) Low product durability
(4) Heavy dependence on disposable products
(5) Low Reuse and Recycling rates
(6) Lack of personal and government comment to reduce waste
(7) Widely dispersed populations.
(8) Relatively cheap energy and abundant land for disposal in developed countries.

AGRICULTURAL WASTES:

Agricultural wastes also produce land pollution considerably. Agricultural solid waste includes decaying plants, crop residues, waste includes decaying plants, crop residues, animal manure, wood, garbage, weed cow-dung, biogases and pesticides. Although crop residues and animal manage are generally recycled into the solid on the forms when they are reproduced but they also constitute the single largest source of non-point air and water pollution in the convened area-pesticides are another important agricultural waste which are not regulated properly. Rules demand that leftover pesticides be diluted and sprayed into the environment.

INDUSTRIAL SOLID WASTES

While municipal solid wastes are generally non-toxic industrial solid wastes are usually hazardous and toxic chemical and petroleum industries produce the most hazardous and toxic solid wastes while metal processing and mining industries are second in producing toxic wastes.

Legally, a hazardous waste is any descended material, liquid or solid that contains substances known to be:

(1) Fatal to humans or laboratory animals in low doses.

(2) Toxic, carcinogenic, mutagenic, or teragogenic to humans or other life forms.

(3) Ignitable with a flash point less than 60C.

(4) Corrosive.

(5) Explosive or highly reactive material.

(6) Radioactive substances.

Management for Hazardous Wastes

Almost all developed countries and to a lesser extent, the less developed countries face two hazardous waste problems. Firstly, how do they clean up existing hazardous waste sites, leaking storage tanks and polluted groundwater? Secondly, how do they deal with the enormous amounts of hazardous waste produced each year to avoid creating new sites and further contamination of groundwater?

The first problem requires immediate action. It is one place where the Bond-Air approach is appropriate. All solutions that fall into this category must be sustainable; they must not merely shift the problem from one location (a contaminated factory site) to another (a landfill where the hazardous wastes are dumped). The second problem calls for long-term preventive measures that eliminate the production of wastes.

Options for Dealing with Hazardous Wastes:

A three tier hierarchy of options for handling hazardous wastes include:

(1) In-plant options

(2) Conversion of Hazardous to less or non-hazardous wastes

(3) Perpetual storage.

(1) In-Plant Options:

The top tier includes in-plant options that reduce the production of hazardous waste in the first place. It contains the most desirable options. These options qualify as highly sustainable practices because they reduce hazardous-waste output-avoiding the need to dispose of waste. In-plant options include three general actions namely:

(i) **Process Manipulation:**

It involves alterations in manufacturing processes to cut waste production. On alteration of manufacturing is known as substitution which involves the use of non-toxic or less toxic substitutes, in manufacturing. Industries can also change the chemical composition of their products, eliminating those that are harmful or that might produce harmful by-products during manufacturing. Non-toxic household cleaners and a good example.

Another type of process manipulation involves the monitoring of manufacturing process to locate and fix leaks that air emitting toxic chemicals into the environment.

(ii) **Re-Use**

In some instances, companies can capture toxic wastes and with little or no purification, or sell them to other companies for re-use.

(iii) **Recycle**

This is also an example of reusing or recycling the toxic wastes inside the plant. In metal finishing, nickel that is left behind in rains, water can be recovered and reused or sold. For plants that cannot afford onsite technologies, shared facilities or third-party recyclers can provide an economical alternative.

The reuse and recycling strategies help cut the output of waste by putting perfectly good materials to use. These strategies the companies a lot of money in materials cost. In addition, they eliminate the cost of waste disposal, cut down on potential environmental and health damage and eliminate costly cleanups.

(2) **Conversion to Less Hazardous or Non-hazardous Substances**

Although re-use and recycling can reduce the toxic wastes but unfortunately not all waste can be eliminated, re-used or recycled. Some waste will always be produced. In such cases, remaining wastes is destroyed or detoxified that is converted to less hazardous or non-hazardous materials. Detoxification can be affected by a member of means like:

- (i) **Incineration**
- (ii) **Land Treatment**
- (iii) **Ocean and Atmospheric Assimilation**
- (iv) **Chemical, Physical and Biological Treatment**
- (v) **Thermal Treatment**
- (vi) **Low temperature Decomposition**

(3) **PERPETUAL STORAGE**

In plant modifications and conversion techniques that destroy or detoxify wastes cannot rid us of all of our hazardous waste. According to an estimate about 25 to 40% of the wastes stream will remain even after the best efforts to reduce, re-use, recycle and destroy it. Residual hazardous waste could be stored by the following options:

- (i) Secured Lanfills
- (ii) Underground Injection
- (iii) Arid Region Unsaturated Zone
- (iv) Surface Impoundments

(v) Waste Piles

RADIOACTIVE WASTES

High level radioactive wastes are some of the most hazardous of all wastes, but they have long been ignored by many countries. More than 500 depleted nuclear power plants are waiting to be decommissioned in this world this is the biggest land pollution. The nuclear wastes should be recycled or stored deep down in the interior of the earth with leak proof lead containers. Some people are of the view that the nuclear power should be phase out to overcome the problems of disposal.

THE WASTE STREAM IS EVERYTHING WE THROW AWAY:

The waste stream is a term that describes the steady flow of varied wastes that we all produced, from domestic garbage and yard wastes to industrial, commercial and construction refuse. Many of the materials in our waste steam would be valuable resources if they were not mixed with other garbage. Unfortunately, our collecting and dumping together, making separation an expensive and sometime impossible task. In an incinerator, much of the value of recyclable materials is lost.

Another problem with refuse mixing is that hazardous materials in the waste stream get dispersed through thousands of tons of miscellaneous garbage. This mixing makes the disposal or burning of what might have been rather innocuous stuff a difficult, expensive and risky business.

DISPOSAL OF MUNICIPAL WASTE

Municipal waste is a combination of household and commercial refuse. Modem waste disposal methods stress the "three Rs of Reduction, Reuse and Recycling before destruction or finally, secure storage of wastes. Various options for the disposal of municipal waste include:

(i) Dumps and Landfills

Open, unregulated dumps are still the predominant method of waste disposed in most of the developing countries but is pollutes the air and the surroundings because the waste is exposed to the wing, and rain as well as rats and flies. Open dumps are being replaced by sanitary landfills. Landfills have been a convenient and relatively inexpensive waste disposal option in most places.

A positive trend in landfil management is methane recovery. Methane or natural gas, is a natural product of decomposing deep in a landfil. It is also an important greenhouse gas. Bio-gas produced in this way can be used as fuel and for the production of electricity.

2. INCINERATION

Incineration is another output control widely used in many industrial countries. Burning trash can reduce the waste volume by two-thirds, cutting requirements for landfil space. Incineration can also be used to produce heat and electricity. Because of this, incinerators are often called waste-to-energy plants. About one ton of garbage is equivalent to about one ton barrel of oil. Incineration produces energy but causes air pollution.

Incinerators may seem like a good way to solve the rowing trash problem but critical thinking suggests the need for a long term view of the problem. The most important question today is not just how to reduce land-filling, but how to cut our waste; conserve valuable resources. protect our air, water and land. An ensure vital wildlife habitat. In short the time demands how do we create a sustainable system of waste management? No doubt, incinerators reduce trash but do not contribute significantly to the goals of sustainability.

SUSTAINABLE OPTIONS FOR THE DISPOSAL OF MUNICIPAL WASTE:

(a) THE INPUT APPROACH

(1) **Increasing Product Life Span: Making More Purable Products**

(2) **Reducing the Amount of Material in Product and Packaging.**

(3) **Reducing Consumption**

(b) THE THROUGHPUT APPROACH

(i) Recycling, Reuse

In natural systems, all waste is food material for other organisms. In short, there is no waste. Everything is recycled. Extensive recycling can help in creating a sustainable society. Recycling is part of the throughput approach. The second put of this approach is reuse. Both strategies remove useful materials from the waste stream and channel them back to manufactures.

(a) The Reuse Option:

Reuse is the return of operable or repairable goods into the market system for someone to use. Many pick up used products, including clothes, shoes, silverware, plates, pans, books, tools, bicycles and appliances. These products are cleared and then resold to the needy. Packaging materials—such as cardboard boxes, bottles and grocery bags—can also be reused saving both energy and materials. Shopping bags can be reused by individuals. Reusable beverage countries can be sterilized, refilled and returned to the shelf.

Besides saving energy, **the Reuse Option:**

(i) Reduces the land area needed for solid waste disposal

(ii) Provides jobs

(iii) Makes available inexpensive products for the poor and thrifty.

(iv) Reduces litter

(v) Decreases the amount of materials consumed by society.

(vi) Helps reduce pollution and environmental degradation.

(a) The Recycling Option:

Recycling refers to the return of materials to manufactures, where they can be melted down or chopped up, refashioned into the original finished material, and then incorporated into products. Thermoplastic materials can be easily recycled by melting them down and reinforcing them with additive materials to bring them back, for reuse. Similarly, paper is shredded, immersed in water, de-linked and then used to make more paper. Recycling of metals is also a convenient method for their disposal. Aluminum recycling offers great benefits as well because it requires 95% less energy than making aluminum from raw ore.

Aluminum recycling produces 95% less air pollutions as well. Similarly environmental benefits are available from recycling other metals and plastics.

COMPOSTING

It is another valuable throughput strategy that reduces waste on large scale. Recycling household waste is the bedrock of recycling programs, but large scale recycling is COMPOSTING is a process in which nutrients from organic wastes such as leaves, grass clippings, cardboard and paper are returned to the soil. Composting allows natural aerobic (oxygen rich) decomposition to reduce organic debris to a nutrient rich soil amendment. Composting is a form of nutrient recycling.

In most large-scale operations, organic matter is collected from various sources, stockpiled, mixed with some dirt, and them allowed to decompose with the help of bacteria. Composting may occur in backyards, in neighborhood facilities or in large municipal operations. Widespread composting, combined with recycling can result in substantial reduction in municipal waste.

ROLE OF REMOTE SENSING AND GIS in Environment Science

Remote Sensing:

Introduction:

Remote Sensing according to Campbell (1987) is the science of deriving information about the earth's land water areas form images acquired at a distance. It relies upon measurement of electromagnetic energy reflected or emitted from the features of interest. Lillesand and Keifer (1979) defined Remote Sensing as the science or art of obtaining information about an object, area or phenomenon through the analysis of the data acquired by a device that is not in contact with the object area or phenomenon under investigation. Regardless of the orientation of the various definitions of Remote Sensing, the acquisition of images of earth surface features, using sensors, through the electromagnetic spectrum, the synoptic view advantage and Remote Sensing's ability to provide data for scientific technological and sustainable management and monitoring of the environment offer' a convergence.

The use of remote sensing for Environmental Management:

(a) Environmental Monitoring

Conservation authorities are concerned with monitoring the quantity, health and diversity of the earth's forests. The remote sensing data are using for the following applications-

(i) Deforestation (rainforest, mangrove colonies)
(ii) Species inventory.
(iii) Watershed protection (riparian strips)
(iv) Coastal protection (mangrove forests)
(v) Forest health and vigor.

(b) Geological Application

Geology involves the study of landforms, structures and the subsurface, to understand physical processes creating and modifying the earth's crust. It is most commonly understood as the exploration and exploitation of mineral and hydrocarbon resources, generally to improve the condition and standard of living in society. It is also the study of potential hazards such as volcanoes, landslides and earthquakes. Remote sensing is used as a tool to extract information about the land structure, composition or subsurface. The use of remote sensing technology in geological resource management are given below:

(i) Surficial deposit/bedrock mapping
(ii) Litho logical mapping
(iii) Structural mapping
(iv) Sand and gravel exploration
(v) Mineral exploration
(vi) Hydrocarbon exploration
(vii) Environmental geology
(viii) Geobotany
(ix) Baseline infrastructure
(x) Sedimentation mapping and monitoring
(xi) Event mapping and monitoring
(xii) Geo-hazard mapping
(xiii) Planetary mapping

Urban Mapping Applications

The majority of remote sensing work has been focused on natural environments over the past decades. Applying remote sensing technology to urban areas is relatively new. With the advent of high resolution imagery and more capable techniques, urban remote sensing is rapidly gaining interest in the remote sensing community. Driven by technology advances and societal needs, remote sensing of urban areas has increasing become a new arena of geospatial technology and has applications in all socioeconomic sectors.

Urban landscapes are typically a complex combination of buildings, roads, parking lots, sidewalks, garden, cemetery, soil, water, and so on. Each of the urban component surfaces exhibits a unique radiative, thermal, moisture, and aerodynamic properties, and relates to their surrounding site environment to create the spatial complexity of ecological systems. To understand the dynamics of patterns and processes and their interactions in heterogeneous landscapes such as urban areas, one must be able to quantify accurately the spatial pattern of the landscape and its temporal changes.

(c) Water Pollution control

Since water is an excellent neutral blackbody radiation. TIR radiometric data can be coupled with fluid dynamics and heat transfer theories to evaluate and refine existing mathematical and physical hydrodynamic models. Aerial TIR data can be effectively used for such a purpose. Many researchers investigated the use of remotely sensed MSS data for water quality mapping in inland and estuarine systems. The high resolution data of TM, SPOT, and IRS permit more accurate of water quality mapping. Remote sensed data for mapping chlorophyll and other water quality parameters has also been reported. Developed regression models to represents best relationships between salinity, turbidity, total suspended solids and chlorophyll concentrations and the corresponding mean radiance values from LANDSAT MSS data for San Francisco Bay and Delta. The CIR, TIR data are used for salt water intrusion. The UV, TIR, MW sensors are used to detect oil spills. The V, C, CIR sensors are used for pollution control related to agriculture, forestry, mining, and land development activities.

(d) Application of Remote Sensing in Coastal Ecosystem Management

Based on remote sensing a variety of data pertaining to the coastal zone like, identification of plant community, biomass estimation, shoreline changes, delineation of coastal landforms and tidal boundary, qualitative estimation of suspended sediment concentration, chlorophyll mapping, bathymetry of shallow waters, etc. can be collected and all these data will help in effective coastal ecosystem management.

GIS IN ENVIRONMENTAL SCIENCE

Real World Example Applications of GIS

Disaster Management

Hurricane Katrina is seen by many as the first time that GIS was used a disaster management tool. Thanks to newly available technology, the first responders on the ground shared a great deal of data about street plans—particularly which streets were and were not accessible and the extent of the flooding. Despite that FEMA and the government came in for criticism, many agree that the efforts of data transmission both prior to and during initial relief efforts were vital to relief efforts.

2014 was a terrible year for drought for the SW United States, increasingly, GIS is being used to manage environmental problems and specifically in disaster relief. Environmental experts have plotted the reporting of official droughts in most of these areas and shape files are now available of the affected region.

Civic Planning

GIS has been a superb tool for rural and urban planning for the last few decades, working out local tax rates, planning desirability and mapping social deprivation, where new roads could go or which should be prioritised for repair. It is now a vital part of our green future too (13). As with regular and previous methods of planning utilities, using the landscape is far more critical to planning. Cascade in Montana is a prime site for wind farms and there is a website that uses GIS data to plot wind speeds over the course of a year in order to best site the wind farms.

THE ROLE OF GIS AND ENVIRONMENTAL MODELLING

Far less ecological research has been undertaken at the meso and topo-scales compared to the global, micro and nano-scales. In fact it is only since the relatively recent development of certain computer-based analytical methods that it has been possible to effectively deal with the primary environmental regimes at these scales. CIS-related techniques have been critical as the problem has been to deal with these processes in a spatially distributed manner.

For example, the climatic interpolation and gridding work of M.F. Hutchinson, H.A. Nix, J.P. McMahon and colleagues (Hutchinson et. al. 1984, Nix 1986) has provided a hitherto unavailable capacity to generate spatially reliable estimates of the meso-scaled climatic inputs to the primary environmental regimes. These have been applied at the meso-scale, using a variety of ecological criteria. The advantages of this method stem partly from the explicit incorporation of additional variables to that of the position of the climate stations as independent variables in the surface fitting procedure. This means that elevation lapse rate effects can be effectively dealt with, resulting in standard errors for temperature predictions of around 0.5 degrees Celsius, and for precipitation of 10-15%.

Similar GIS-related developments have transformed our ability to spatially model processes at the topo-scale. The advent of digital elevation models and associated terrain analysis algorithms means that the topo-scaled effects on the primary environmental regimes can be now factored in. The TAPES suite of software by Ian Moore and colleagues (Gallant and Wilson *in press* 1996, Wilson and Gallant *inpress\996*. Wilson and Gallant *in review* 1996) provide the capacity to account for both the catchment hydrology and radiation shading processes that dominate in erosional, humid forested landscapes (see Moore et al. 1993, Mackey 1994, Mackey et al. 1995). The limiting factor becomes the availability of suitably scaled indices of the PERs. While critical processes at the meso and topo-scales can now be captured, the reliability of spatial data decreases at the micro and nano-scales.

The main sources of spatial data about the substrate remains thematic maps of bedrock and surficial geology (though developments in the application of remotely sensed radiometric data are promising). However these are generally derived for prospecting and engineering purposes, and the mapped units may have little direct interpretation in terms of the mineral nutrient regime experienced by plants. One approach is to reclassify the mapped data to reflect the relative potential of each class as a source of potential nutrients assuming soil has developed *in situ* on this parent material. This can be done qualitatively with the aid of an experienced geologist, or at least semi-quantitatively if adequate rock chemistry data are available. In this way, the meso-scaled influence of parent material lithology can be coupled to similarly scaled climate models to define spatial estimates of the PERs inclusive of the mineral nutrient regime.

The increased capacity provided by GIS and spatially distributed environmental modelling enables two fundamentally new analytical capabilities.

Spatial Modelling of Physiological Niche

CONCLUSION

GIS and environmental modelling provide the means to directly model the potential habitat of specific taxa, so long as adequate empirical data about their distribution and productivity are available to calibrate their response to the PERs. Hence great advances are now possible in the spatial analysis of a taxa's physiological niche, and the incorporation of other data needed to estimate its ecological niche. However lack of appropriate biological data in light of the pace at which resource utilisation is occurring, demands complimentary approaches such as that provided by EDA.

POPULATION PLANNING

Population planning is a structured way of thinking and taking action to improve the lives of children, families and communities as a whole.

As one of the key Brighter Futures projects, population planning will inform how our services are organised, and ultimately assist in making decisions about the actions planned. These decisions will be made on evidence gathered through an agreed process rather than anecdotes with contribution from the community and key partners. The process has a strong focus on long term improved outcomes for children and young people.

Population Control:

One of the gravest development issues most developing countries in the world are facing is population. As per United Nations population statistics, the world population grew by 30% between 1990 and 2010 which is an alarmingly high rate. Excessive population has various adverse effects including undue pressure on natural resources. More people mean more consumption which in turn means more exploitation of fixed and exhaustible resources. Also population is not a universal challenge. It is specific to nations whose economies have yet not achieved full potential and development. Alongwith China and India, the African and some Latin countries also see an extremely high population growth rate. Rather China, which is the most populated nation, has achieved a very appreciative control over their growth of population though their ways are highly autocratic and cannot be replicated in other countries.

Below are the most effective measures which can be employed to control population growth:

1. DEVELOPMENT

Why the enormous population and the increasing rate of it is the biggest challenge faced by the developing nations of Africa and Asia while the same is a little or no threat in countries like America, Europe or Japan. Lack of Development implies high poverty, high illiteracy, high discrimination, lack of awareness, lack of medical facilities and thus in turn increased population growth. Any economy is termed developed is its population is non-discriminated and just. By reducing discrimination between gender and class and ensuring development of the whole population instead of a given segment of society would eliminate the challenge of population growth for once.

2. EASY AND CHEAP AVAILABILITY OF CONTRACEPTIVES

Ensuring that people have easy and cheap access to contraception tools will help avoiding cases of unwanted pregnancies and births. Every state owned hospital should be made to provide cheaply efficient birth control medicines or surgeries since poor people have neither the means not awareness to use contraception. Use of condoms and contraceptives must be advertised and promoted alongwith ensuring cheap and ready access to these. Contraceptives do not only prove to be an important population control measure but also prevents spreading of sexually transmitted diseases like AIDS thus ensuring small healthy families.

3. EDUCATION

Education forms the backbone of an individual and economy. Once educated people know and understand the harms which a high population growth rate possesses. Education, especially women education, can work wonders in controlling population. An educated man and woman can readily understand the benefits of a small family. Without sufficient education most measures like awareness campaigns and women empowerment will prove to be insufficient arid pointless.

4. ERADICATE POVERTY

Why most poor countries have highest population growth instead of rich ones. Poverty has a direct relation to the population growth. In developing countries of Asia and Africa, child labor, slave trading and human trafficking is highly prevalent. African countries for example still have maximum reporting of slave trading though trading of humans is legally banned everywhere in the world. People give birth to kids and sell them to rich people who in turn employ these kids in various laborious and unethical tasks. If not sell, these parents force their kids lo beg or work at a very tender so as to earn some extra money for the family. These people believe that more kids mean more hands for begging and work and thus more money. Without concrete measures for growth and poverty eradication, other methods of population control may prove to be ineffective.

5. WOMEN EMPOWERMENT

In most developing countries, the women folks are not considered equivalent to men in terms of force and might. Such opinions are extremely common in Islamic countries. Gender discrimination is a major reason for population growth. People keep giving birth to kids in order to have more sons than daughters. Empowering woman with a say in matters concerning them like child birth and educating them to fight against discrimination will ensure a healthy and aware society.

6. SPREAD AWARENESS

People need to be told and made to understand the consequences of having too many children. Government and non-government institutions can carry awareness campaigns informing people how they will be unable to provide good nutrition, education or medical facilities to their children if they have too many. Population is also a reason for illiteracy and diseases and malnutrition and the negative effects of it are required to be communicated to the general public to expand their reasoning and understanding.

7. PROVIDING INCENTIVES

Incentives have proved to be an efficient policy measure in combating most development issues including population. Providing a health, educational or even financial incentive can be a highly effective population measure. There are certain incentive policies like paying certain some of money to people with not more than two kids or free or discounted education for single child etc. which are in place in most developing countries facing population related challenges and has also proved to be a useful measure.

8. LEGISLATIVE ACTIONS

Not much result can be achieved from these if family planning and use of contraception remains optional instead of mandatory. Strict legal steps are required for child marriage, education, abolition of child labor and beggary and family planning to reap significant benefits from it. Proper enforcement of laws related to child labor, slavery and beggary will ensure that parents don't sell their children or send them out to work thus forcing them to raise lesser number of kids.

9. MEDICAL FACILITIES

One big drawback of developing countries is that of limited and highly centric medical facilities. Because of the high rural-urban divide in developing countries, availability of good hospitals and doctors is limited to urban centers thus resulting in high infant mortality rate in rural areas. Rural people, in order to ensure that at least some of their kids survive, give birth to more and more kids thus contributing to the population growth. If provided with optimum medical facilities population rate will almost certainly decline.

10. DELAYED MARRIAGES

The problem of child marriage is highly prominent in certain countries with high population like Pakistan or Bangladesh. A marriage at a tender age leads to a long span for giving birth. Also young age marriage devoid people of the education and awareness required to be sensitive towards and understand the consequences of raising too many children. A UN report has suggested that there would be a significant decline in world population if the legal for marriage is made 20 years.

FIVE POPULATION STRATEGIES TO STOP SHORT OF 9 BILLION

⇒ **End all policies that reward parents financially based on the number of children they have.** Governments can preserve and even increase tax and other financial benefits aimed at helping parents by linking these not to the number of children they have, but to parenthood status itself

⇒ **Integrate lessons on population, environment, and development into school curricula at multiple levels.** Refraining from advocacy or propaganda, schools should educate students to make well-informed choices about the impacts of their behavior, including child-bearing, on the environment.

⇒ **Put prices on environmental costs and impacts.** In quantifying the cost of an additional family member by calculating taxes and increased food costs, couples may decide that the cost of having an additional child is too high, compared to the benefits of a smaller family that might receive government rebates and have a lower cost of living. Such decisions, freely made by women and couples, can decrease birth rates without any involvement by non-parents in reproduction.

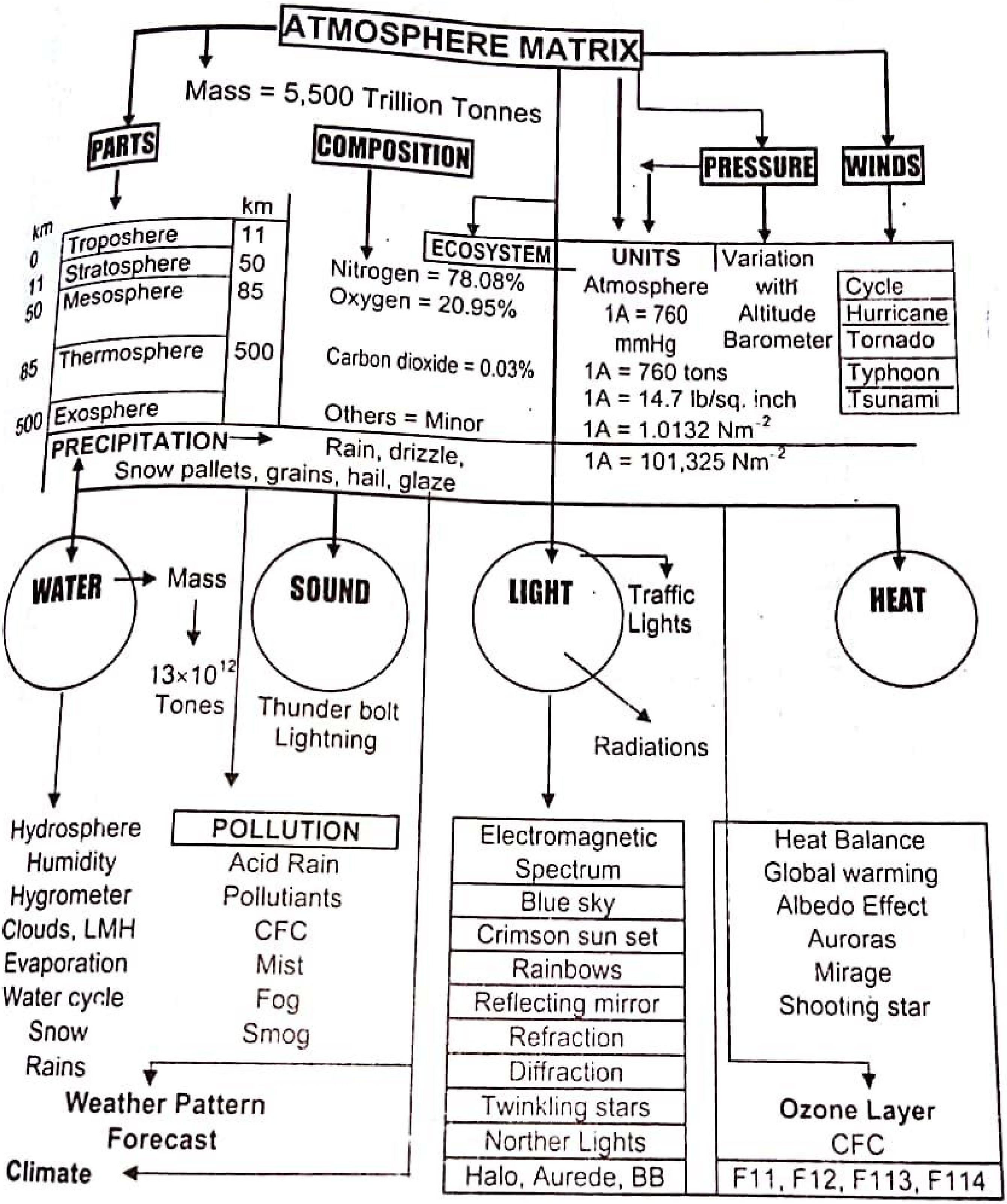
⇒ **Adjust to an aging population instead of boosting child-bearing through government incentives and programs.** Population aging must be met with the needed societal adjustments, such as increased labor participation, rather than by offering incentives to women to have more children.

⇒ **Convince leaders to commit to stabilizing population growth through the exercise of human rights and human development.** By educating themselves on rights-based population policies, policy-makers can ethically and effectively address population-related challenges by empowering women to make their reproductive choices.

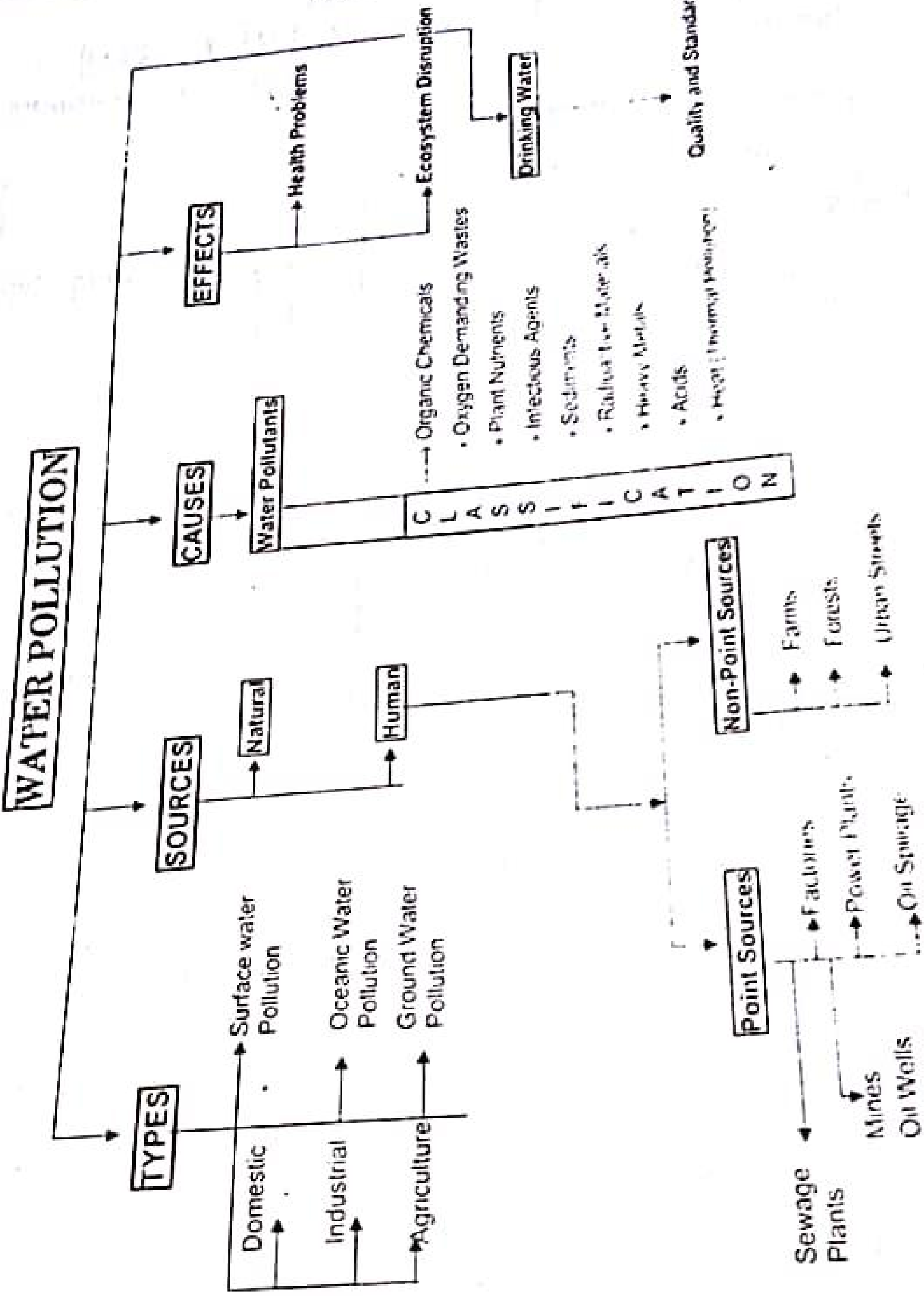
CONCEPT MAP

THE FOUR SPHERES OF THE EARTH

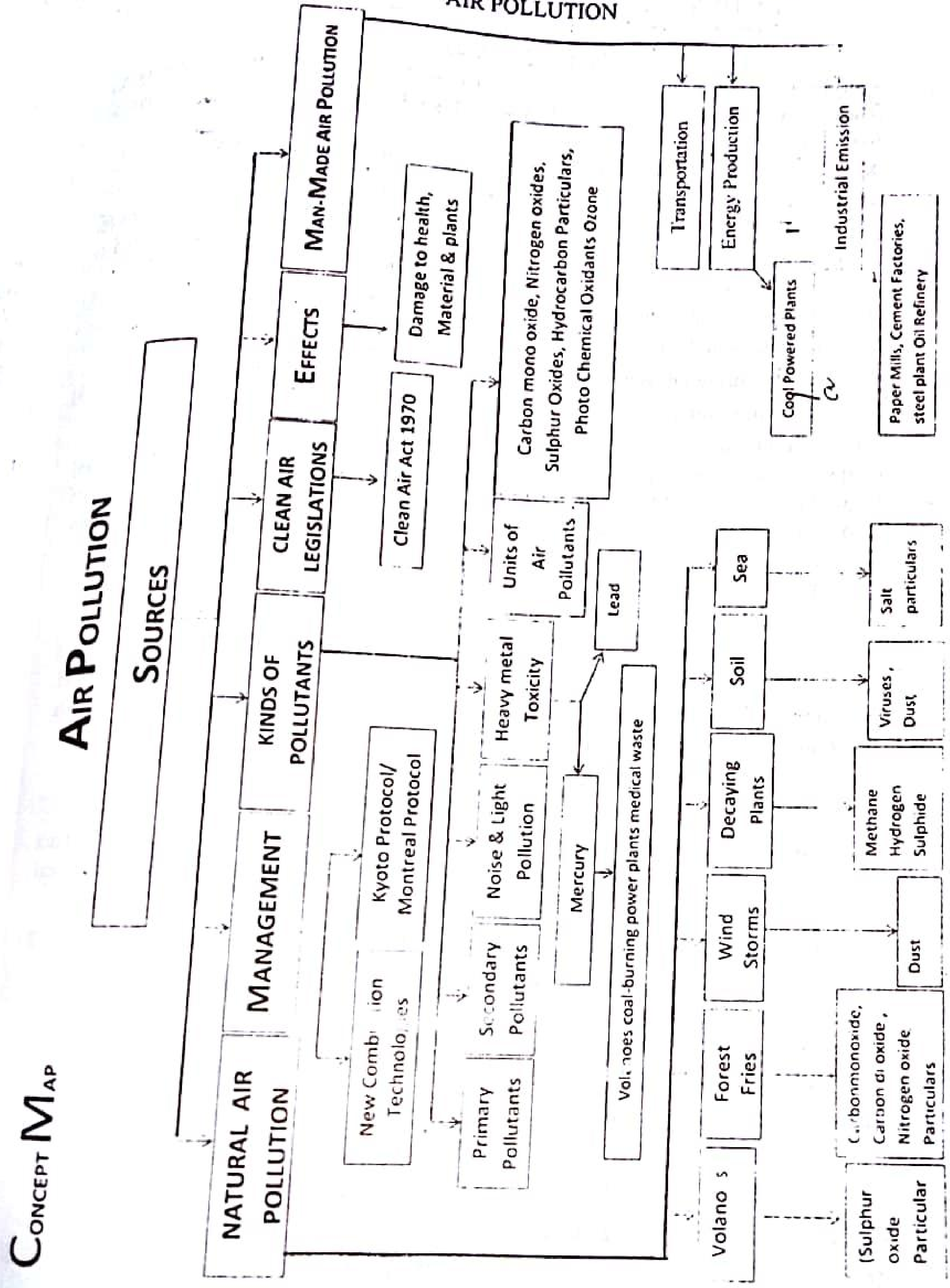
BIOSPHERE ATMOSPHERE LITHOSPHERE HYDROSPHERE



WATER PULLUTION



AIR POLLUTION



MULTIPLE CHOICE QUESTIONS

CHEMISTRY

1. Acetylene is a colourless and highly inflammable gas. It burns with intensely hot flame. Which of the following chemical reaction is used for the production of Acetylene?
   - (a) Calcium hydride and water
   - (b) Calcium carbide and water
   - (c) Calcium nitride and water
   - (d) None of the above

2. The Ox/acetylene torch can produce a temperature upto 3500 C and it is used for welding and cutting metals. Which of the following mixture of gases is used to produce this flame?
   - (a) Acetylene and hydrogen
   - (b) Acetylene and ethylene
   - (c) Acetylene and nitrogen
   - (d) Acetylene and oxygen.

3. Which of the following is not an alloy?
   - (a) German silver
   - (b) Bronze
   - (c) Aluminum
   - (d) Brass

4. Caffeine is an organic compound, belongs to an Alkaloid family and it is extracted from plants. It is a mild stimulant for the human body. It triggers the release of fatty acids, increases the heart rate, speeds up metabolism and increases urine output. Name the food which contains small amounts of caffeine
   - (a) Tea
   - (b) Coffee
   - (c) Soft drinks
   - (d) All the above

5. Kaolin or China clay has a high fusion point and is the most refractory of all clays. It is mainly used in refractories, electric ceramics, cements, fertilizers, catalyst carrier, insulators, cosmetics, insecticides and as an adsorbent for classification of liquids. What are main chemical constituents of Kaolin?
   - (a) Hydrated Aluminum silicate
   - (b) Calcium carbonate
   - (c) Sodium sulphate
   - (d) Aluminum sulphate

6. Limonite, bloodstone or hematite are three different names given to a very important ore of a transition metal. It is used for paint pigments and rouge. What is its chemical name?
   - (a) Cobalt oxide
   - (b) Nickel Oxide
   - (c) Chromium Oxide
   - (d) Iron Oxide

7. Name a naturally occurring radioactive gas.
   - (a) Helium
   - (b) Argon
   - (c) Krypton
   - (d) Radon

8. Name a gas which was first discovered on the Sun and later on the Earth.
   - (a) Hydrogen
   - (b) Nitrogen
   - (c) Helium
   - (d) Oxygen

9. Which out of the following elements is not a liquid at room temperature?
   - (a) Mercury
   - (b) Bromine
   - (c) Galino
   - (d) Sodium

10. Name the element which has maximum number of naturally occurring isotopes.

(a) Hydrogen
(b) Carbon
(c) Tin
(d) Iron

11. The composition of the Sun can be determined by analyzing its spectrum. Spectra are of various types. The spectrum of the Sun is:

(a) Band Spectrum
(b) Dark Spectrum
(c) Continuous spectrum
(d) Line spectrum

12. Name the gas which is used in preparing soft drinks.

(a) Hydrogen sulphide
(b) Carbon dioxide
(c) Ammonia
(d) Oxygen

13. Name the gas which is used in fire extinguishers.

(a) Nitrogen
(b) Helium
(c) Carbon dioxide
(d) Hydrogen

14. Name the gas which Is used in refrigerators:

(a) Freon
(b) Dry ice
(c) Ammonia
(d) Nitrogen dioxide.

15. The reservoirs of fossil fuels will not last for ever. Scientists are now trying to find an alternative fuel for petroleum. Name the chemical compound which can act as an alternative fuel for driving vehicles.

(a) Ethene
(b) Ethaol
(c) Ethane
(d) Ethanoic acid

16. Previously organic compounds could only be obtained from living organisms but later many of them were synthesised in the laboratory. Name the first synthetic organic compound.

(a) Glucose
(b) Sucrose
(c) Urea
(d) Glycine

17. Calcium is present in the largest amount in a human body. Name the element which is present in the smallest amount

(a) Phosphorous
(b) Manganese
(c) Zinc
(d) Iodine

18. Sulphuric acid is a very important inorganic chemical. Annual production of this acid acts as an index of industrial development of a country. What is the other name of sulphuric acid?

(a) Oleum
(b) Sulphurous acid
(c) Sulpher dioxide
(d) Oil of vitriol

19. What is the chemical name of a gas which is remembered as Marsh gas, natural gas or cooking gas?

(a) Hydrogen
(b) Helium
(c) Methane
(d) Alcohol

20. Organic compounds are widely distributed in nature in various forms. Name the most abundant organic compound in the world

(a) Glucose.
(b) Cellulose

(c) Methane
(d) Alcohol

21. A special light and hard alloy is formed when magnesium metal is combined with aluminum, zinc, copper and manganese. It is used for making propellers of engines and aircraft. Name the alloy.

(a) Electrum
(b) German silver
(c) Brass
(d) Steel

22. Greeks believed that the whole world is made up of only four basic elements – Earth, Water, Air and Fire. Name the person who put forward this idea.

(a) Aristotle
(b) Kapila
(c) Berzillius
(d) Cavendish

23. When Naphthalene is heated, it:

(a) Melts
(b) Reacts
(c) Boils
(d) Sublimes

24. Diamond is the hardest naturally occurring substance known. Which of the following synthetic substances is even harder than diamond?

(a) Carborundum
(b) Alundum
(c) Chrome steel
(d) Borazon (Boron nitride)

25. Which of the following metals is highly malleable and ductile?

(a) Iron
(b) Copper
(c) Gold
(d) Sodium.

26. All the known elements are arranged in the form of a Periodic Table, based upon their classification. It has taken more than one hundred years to bring the periodic ble in the present modern form after a series of developmets. Which of the [illegible] buted towards its development?

(b) Mendeleve
Newlanu
(d) Joseph Priestely

The properties of the elements are a periodic function of their atomic numbers." This is called the Modem Periodic Law first stated in 1911. Who stated this law?

(a) Mosley
(b) Mendeleeve
(c) Lavoisier
(d) Lothar Meyer.

28. The elements with similar properties are repeated at regular intervals in the periodic table. What is this statement called?

(a) Homology
(b) Periodicity of properties
(c) Analogy
(d) Lengthening of chains

29. Electrochemical properties of elements put them into two categories – electropositive and electronegative. Which out of the following is the most highly electronegative elements of the periodic table?

(a) Argon
(b) Fluorene
(c) Chlorine
(d) Oxygen

0. Hydrogen is the simplest element known. Being the lightest, it is also filled in the weather balloons. It is inflammable and water-producer. Who discovered hydrogen gas?

(a) Cavendish
(b) Lavoisier
(c) Dalton
(d) Newland

31. Which isotope of hydrogen is radioactive?
(a) Protium
(b) Deuterium
(c) Tritium
(d) None of the above.

32. How many times is hydrogen gas higher than air?
(a) 14 times
(b) 10 times
(c) 8 times
(d) 4 times

33. Below is given pairs of sodas with their chemical names. Which out of the following is a wrong pair?
(a) Caustic soda; Sodium hydroxide
(b) Washing soda; Sodium Carbonate
(c) Baking soda; Sodium bicarbonate
(d) Soda ash; Sodium sulphate.

34. Below is given some important inorganic materials used in daily life alongwith their chemical names. Which out of the following is a false pair?
(a) Bleaching powder, Calcium oxychloride.
(b) Borax; Sodium tetraborate
(c) Hypo; Sodium thiosulphate
(d) Plaster of Paris; Sodium phosphate

35. Ores are those rocks from which the metal can be extracted economically. Below is given some ores alongwith their chemical names. Which out of the following is a wrong pair?
(a) Epsom; Magnesium sulphate
(b) Chile salt peter; Sodium nitrate
(c) Natron; Potassium carbonate
(d) Sylvite, Potassium chloride.

36. Aluminum is a dull grey light metal and it finds a lot of "applications in making buses, trains and aeroplanes. It is mostly used in the form of alloy Which out of the following is not an alloy of Aluminum
(a) Alnico
(b) Brass
(c) Magnalium
(d) Duralumin

37. Alum (ferric, potash and chrome) are double sulphates of potassium, aluminum , iron, chromium and ammonium with 24 molecules of water of crystallization. These are extensively used in daily life. Which out of the following industries does not use alums?
(a) Textile industry
(b) Leather industry
(c) Ghee industry
(d) Paper industry

38. Chlorine is a poisonous greenish yellow gas with a pungent odour but it has lot of uses. Where it is not used?
(a) Purification of water
(b) Preparation of war gases.

(c) Preparation of pesticides. (d) Preparation of soaps.

39. Pure concentrated sulphuric acid is a colourless viscous oily liquid Which of the following property does not crorrespond to sulphuric acid.

(a) Strong oxidising agent (b) Monobasic acid
(c) Dehydrating agent (d) Corrosive substance

40. Graphite and Diamond are two well-known different physical forms of pure carbon These are also said to be:

(a) Allotropes (b) Azeotropes
(c) Anisotoropes (d) Isotopes.

41. Some inorganic chemicals are better remembered by their nicknames which of the following pair is a wrong choice?

(a) Lunar caustic, silver nitrate
(b) Surkh Kai; potassium dichromate
(c) Blue vitriol; copper sulphate
(d) Cuprite; silver oxide.

42. Which of the following is not a fossil fuel?

(a) Petroleum (b) Coal
(c) Natural gas (d) Biomass.

43. Which of the following is not a class of coal?

(a) Anthracite (b) Wood
(c) Lignite (d) Bituminous coal.

44. Crude petroleum is sent to the refinery where it undergoes a series of processes before it can be commercially exploited. Which of the following process is not involved in its refining?

(a) Cracking (b) Electrolysis \
(c) Reforming (d) Polymerization.

45. Which of the following is not a petroleum product?

(a) Kerosene oil (b) Ethers
(c) Xylenes (d) Alkyl sulphonates.

46. Methane is the simplest hydrocarbon. It is colourless and odourless gas with a boiling point of −162 C. Where it is not used?

(a) For illumination
(b) For the preparation of carbon blocks
(c) As a fuel.
(d) For the preparation of sugars.

47. Victor Grignard prepared the most important organometallic compounds with magnesium metal, commonly known as "Grignard Reagent". He was awarded the Nobel Prize in 1912 for his discovery. To which country the scientist belonged to?

(a) Russia (b) U.S.A.
(c) Italy (d) England.

48. Formalin is a 40 percent aqueous solution of formaldehyde (a gas) containing 8 percent methanol. Where it is not used?
   (a) Preservation of biological specimens
   (b) Antisceptic agent and disinfectant
   (c) Silvering of mirrors.
   (d) Oxidising agent.

49. Phenol is that aromatic compound in which the hydroxyl group is directly linked with the phenyl ring. Where is phenol not used?
   (a) Ink preservative
   (b) For the preparation of alcohols
   (c) For the preparation of carbolic soaps.
   (d) Powerful antisceptic agent.

50. Chemistry is that branch of science which deals with transformations of matter and its composition and the principles governing these transformations which of the following is not a branch of chemistry.
   (a) Physical (b) Inorganic
   (c) Organic (d) Anatomy

51. Physical change is that change in which no chemical reaction occurs and the chemical composition of matter remains the same These changes are not permanent and can be easily reversed which of the following processes is not a physical change?
   (a) Melting of ice (b) Fermentation
   (c) Boiling of water (d) Melting of candle wax.

52. Chemical change is that change in which a chemical reaction occurs and the chemical composition of matter does not remain the same. These changes are permanent and can not be reversed easily. Which of the following is not a chemical change?
   (a) Magnetization of iron (b) Burning of paper
   (c) Rusting of iron (d) Electrolysis of water.

53. The most widely used system of measurement today is the modernised metric system of units. These units are known as the SI units __ which is derived from the French name, Le System International d'Unites. In SI, the standard of length is the meter. Which of the following is not the definition of the meter?
   (a) It is the length equal to 1.650, 763.73 wavelengths in vacuum of the orange red light emitted by Krypton
   (b) It is equal to one ten-millionth of the distance from North Pole to the Equator.
   (d) It is distance which light travels in one tenth of second.

54. Gases are simplest form of matter. They have neither definite volume nor definite shape. Gases are characterised by different physical properties. Which of the following is not a property of gases?
   (a) Compressibility (b) Diffusion
   (c) Expansion (d) Melting.

55. "The volume of a given mass of a gas is inversely proportional to the pressure exerted on it provided the temperature is kept constant. It is the statement of which of the following laws?

(a) Boyle's Law (b) Charle's Law
(c) Henry's Law (d) Gay-Lussac's Law.

56. The spontaneous mixing of molecules of different gases by random motion and collisions to produce a homogeneous mixture is called:

(a) Effusion (b) Diffusion
(c) Electrolysis (d) Catalysis.

57. Name the device or instrument which is used to measure atmospheric pressure.

(a) Manometer (b) Barometer
(c) Lactometer (d) Hydrometer

58. Liquid molecules are free to move but cannot separate from each other. Liquids have definite volume and are almost non-compressible. The intermolecular attractive forces are strong in liquids as compared to gases. Which of the following liquids has the maximum attractive forces?

(a) Water (b) Ether
(c) Alcohol (d) Mercury

59. The properties of liquid solutions which depend on the number of solute particles and not on their nature are called colligative properties. Which of the following is not colligative property of the liquids?

(a) Elevation in boiling point (b) Depression in freezing point
(c) Osmotic pressure. (d) Solubility

60. The spontaneous change of a liquid into vapour phase at the surface is called evaporation. Evaporation of liquids cause:

(a) Cooling (b) Heating
(c) Increase in density (d) Decrease in density

61. A freely falling drop of a liquid is always spherical. Which property of the liquid explains this?

(a) Density (b) Viscosity
(c) Surface Tension (d) Fluidity

62. Why does steam produce more severe burns than does the boiling water?

(a) Because water is a polar solvent
(b) Because boiling water has more heat.
(c) Because heat stored in steam is greater than that of boiling water.
(d) Because steam and boiling water are at the same temperature.

63. The spontaneous rise of a liquid in a capillary tube is called capillary action. Which of the following is not an example of capillary action?

(a) A drop of ink spreads up on the blotting paper.
(b) Water rises in plants through the roots.
(c) Kerosene oil rises in the wick of the lamp.
(d) A falling drop of a liquid is spherical.

64. The internal resistance to flow of a liquid is called the viscosity of the liquid. It is measured in poise. Different liquids have different viscosities, it depends upon the molecular size, intermolecular forces and the molecular shape of the liquid. Which of the following liquids has the highest viscosity?

(a) Honey (b) Glycenne
(c) Water (d) Alcohol.

65. Mercury does not wet the walls of the container but water wets the glass surface. Which of the following is the correct explanation?

(a) Water has high surface tension
(b) Cohesive forces in mercury are stronger than the adhesive forces.
(c) Water has low boiling point.
(d) Mercury has high boiling point.

66. Henri Becquerel discovered in 1896 that certain elements spontaneously emit radiations which cause fogging of photographic plates. Such elements are called radioactive elements. Which of the following elements are not radioactive?

(a) Thorium (b) Radium
(c) Uranium (d) Sodium

67. The mystery of the structure of atom was solved after a series of experiments which showed its composite nature. Which of the following scientists has not contributed to this?

(a) Millikan (b) William Crooks
(c) Hittorf (d) Newton.

68. A homogeneous mixture of two or more substances is called a solution. Concentration of a solution can be expressed by various way. Percentage composition is a popular way of expressing solution concentrations. A 10% (w/w) aqueous solution of glucose contains:

(a) 10 grams of glucose dissolved in 90 gms of water.
(b) 10 grams of glucose dissolved in 100 gms of water.
(c) 10 ml of glucose dissolved in 90 ml of water.
(d) 10 ml of glucose dissolved in 100 ml of water.

69. Sixty carbon atoms arranged by 12 pentagons and 20 hexagons constitute a perfect sphere—the roundiest molecule the world has ever seen. This is the third. allotropic form of pure carbon. The geometry of this magic molecule was deciphered by Professor Richard Smalley of Rice University in 1991. What is the name given to this third allotropic form of pure carbon?

(a) Graphite (b) Diamond
(c) Bucky ball (d) None of the above

70. Epcot Center in Florida (U.S.A) is one of the World's largest geodesic spheres, an assemblage of hexagons and pentagons 165 feet in diameter. The geodesic sphere is a sturdy, thermodynamically stable structure. Which allotropic form of pure carbon resembles in structure with that of the geodesic sphere.

(a) Diamond (b) Graphite
(c) Bucky ball (d) None of the above.

71. Photoactive chlorofluorocarbons (CFC's) are used in refrigeration and air-conditioning devices but now their use is going to be restricted because these chemicals have been found to damage the:

(a) Ozone layer
(b) Carbon-dioxide layer
(c) Oxygen layer
(d) Nitrogen Layer.

72. Chlorofluorocarbons (CFC's) are gases and are very unreactive. They pass to the upper layer of the atmosphere unchecked and un-decomposed. What is approximately the average life of a CFC in the atmosphere?

(a) 70-100 minutes
(b) 70-100 hours
(c) 70-100 days
(d) 70-100 years.

73. Chemical warfare began in 1915 during World War I when chemicals such as chlorine, phosgene and mustard gas were used against the British forces. Since then chemical defence has appeared as a very strategic defence. Which of the following chemicals is more commonly used in chemical Warfare?

(a) Sarin
(b) Dichlorvos
(c) Tabun
(d) All the above.

74. Chemicals used in warfare are classified into different categories depending upon their mode of action on the human body. Main classes are blood agents (Cyanogen Chloride), choking agents (Phosgene), Blister agents (Mustard gas) and nerve agents Which of the following is a nerve agent?

(a) Tabum
(b) Sarin
(c) Soman
(d) All the above.

75. Riot control materials are substances that cause temporary and full reversible discomfort, they are not chemical warfare agents. Tear gas is a more commonly used such material. Tear gas was for the first time used in 1912 by the Paris Police. What is its chemical name?

(a) Ortho-Chiorobenzylidene malonitrile
(b) Soman
(c) Phosgene
(d) Mustard gas.

76. Mustard gas is a blistering agent and a classical chemical used in warfare. It was first used in 1917. This chemical produces a variety of lesions __ temporary blindness, respiratory and skin effects. What is its chemical name?

(a) Bis (2 Chloroethyl) sulphide
(b) N, N-Bis (2 chloroethyl) methylamine
(c) 2-chlorovinyl—dichloroarsine
(d) Cyanogen chloride.

77. If a woman has a body temperature of 40 C, how sick is she?

(a) 100°F
(b) 102°F
(c) 103°F
(d) 104°F

78. It is recommended that the temperature of a food freezer be maintained at 0 F. What is this temperature on the Celcius scale?

(a) −10°C
(c) −16°C

(b) −18°C
(d) 0°C.

79. "To understand the very large, we must understand the very small" This was said by a Greek philosopher who lived in the years from 470 to 380 B.C. Name him.
(a) Democritus
(b) Lucretins
(c) Leucippus
(d) Lavoisier

80. "The Sceptical chymist" is the name of a book which was published in 1661 by an Englishman. The book gave the definition of an element based on experiments. Who wrote this book?
(a) J.J. Berzelius
(b) Robert Boyl
(c) J.L. Houst
(d) Lavoisier

81. Name the British scientist who made contributions in the investigations of the structure of atom and determined mass-to charge ratio of Electron. He was awarded Nobel Prize in 1906 for his work. Even more interesting is that his son also won a Nobel Prize later for his studies on Electrons.
(a) Michael Faraday
(b) J.J. Thomson
(c) William Crooks
(d) W. Nicholson

82. Curie's family is remembered for their excellent contributions m understanding the phenomenon of Radioactivity. The family bagged three Nobel Prizes. The golden pin of this family was Madame Marie Sklodowska Curie. She was born in 1867, coined the word radioactivity and was awarded Nobel Prizes two times in 1903 and 1911. Her daughter Irene Joiiot-Curie also won a Nobel Prize in 1935. What was the nationality of Marie Curie.
(a) English
(b) Polish
(c) Italian
(d) Russian

83. Cosmic rays were discovered in 1913 by Victor Frknz Hess, an Austrian Physicist who made his experimental measurements as he ascended into the atmosphere in a balloon. What is the nature of cosmic rays?
(a) Electromagnetic
(b) Non-material
(c) Charged particles
(d) Photons

84. Radioactive isotopes are used as Tracers in Physical, chemical and biological systems. Their main use is in medicines. Name some radioisotopes which are more commonly used in medicine.
(a) Iodine-131
(b) Phosphorous-32
(c) Sodium-24
(d) All the above.

85. A Uranium Atomic Bomb called "Little Boy" was dropped on Hiroshima oh 6 August 1745 by Captain Pau! Tibbets who carried the bomb on his B-29 bomber More than 200. 000 people were incinerated, with thousands suffered from the appalling bums of radiation What was the approximate nuclear fire power equivalent of this bomb to TNT explosive.
(a) 2000 tonnes of TNT
(b) 20,000 tonnes of TNT
(c) 200 tonnes of TNT
(d) 20 tonnes of TNT

86. The boiling point of a liquid depends upon the atmospheric pressure. Its value decreases with increasing altitude. Water boils at 100°C at sea level. What will be the boiling point of water at Mount Everest?

(a) 0°C (b) 91°C

(c) 81°C (d) 71°C

87. Atmosphere of the Earth is a blessing for the mankind. Its main composition is Nitrogen (78%) and oxygen (21%). What is approximately the total mass of the Earth's atmosphere.

(a) 500 million tonnes. (b) 5,500 thousand tonnes

(c) 5,500 trillion tonnes (d) 5,500 billion tonnes

88. X-rays were discovered by W. Roentgen in 1895. These rays are powerful and can damage skin but smaller doses are pretty safe. Rem is a measure of the biological damage produced by a particular dose of radiation. Rem is an acronym for Roentgen Equivalent to Man. About how much X-rays are absorbed by a human body in a single X-ray exposure?

(a) One fiftieth of a rem (b) One tenth of a rem

(c) One-twelveth of a rein (d) One thirtieth of a rem.

89. What is the atomic number of the element which was given three different names officially at different times in the last 25 years? These names in order of priority are Unnilquadium, Kurtchatovium and Rutherfordium.

(a) 101 (b) 102

(c) 103 (d) 104.

90. Tetrahedron is a very stable geometry because the centre of gravity is very close to the base of the system. Which of the following is a practical application of this property in daily life.

(a) Milk is sold in more than 75 countries in tetrapack structure

(b) Egyptian pyramids have stood longer than expected.

(c) Diamond is the hardest naturally occurring substance

(d) All the above.

91. Which of the following is a radioactive element?

(a) Manganese (b) Technicium

(c) Rehenium (d) Sodium

92. Which of the following is not a inner transition element?

(a) Smarium (b) Cerium

(c) Erbium (d) Tungsten.

93. What is the action of heat on camphor?

(a) Melts (b) Decomposes

(c) Boils (d) Sublimes.

94. Which of the following substances is used in making sugar candies to make them soft?

(a) Honey (b) Glycerine

(c) Urea (d) Alcohol

Which of the following is not a transuranic element?

(a) Americium (b) Neptunium

(c) Berkelium (d) Thorium

Which of the following is a very precious metal?

(a) Copper (b) Platium

(c) Tungsten (d) Chromium.

Many substances like Helium, Neon, Sodium and Mercury give off visible light when excited in a electric discharge tube. The phenomenon of atomic emission also turns up frequently in daily life. Which one of the following is an example of such atomic emission?

(a) Street lamps (b) Fluorescent light

(c) Neon signs (d) All the above.

Heavy water is a naturally occuring substance with a formula; of D_2O. It occurs in ordinary water in very amount (in the ratio of 1: 7000). Heavy water is separated from ordinary water by physical methods. It is used in the nuclear power plant as:

(a) Moderator (b) Fuel

(c) Barrier (c) Filter.

Which of the following elements is not a solid at room temperature?

(a) Iodine (b) Sodium

(c) Silicon (d) Bromine.

Athletes often use instant cold packs and hot packs as first aid devices to treat injuries. These devices operate by utilizing the heat of solution concept. A typical pack consists of a plastic bag containing a pouch of water and a dry chemical. Striking the pack causes the pouch to break and the temperature of the changes accordingly. Dry chemical in hot pack is Calcium chloride. Name the dry chemical in cold pack.

(a) Ammonium nitrate (b) Sodium chloride

(c) Magnesium sulphate (d) Potassium chloride.

KEY TO MCQs

1.	(b)	2.	(d)	3.	(c)	4.	(d)	5.	(a)	6.	(d)	7.	(d)
8.	(c)	9.	(d)	10.	(c)	11.	(c)	12.	(b)	13.	(c)	14.	(a)
15.	(b)	16.	(c)	17.	(b)	18.	(d)	19.	(c)	20.	(b)	21.	(a)
22.	(a)	23.	(d)	24.	(d)	25.	(c)	26.	(d)	27.	(a)	28.	(b)
29.	(b)	30.	(a)	31.	(c)	32.	(a)	33.	(d)	34.	(d)	35.	(c)
36.	(b)	37.	(c)	38.	(d)	39.	(b)	40.	(a)	41.	(b)	42.	(d)
43.	(b)	44.	(b)	45.	(d)	46.	(d)	47.	(c)	48.	(d)	49.	(b)
50.	(d)	51.	(b)	52.	(a)	53.	(d)	54.	(d)	55.	(a)	56.	(b)
57.	(b)	58.	(d)	59.	(d)	60.	(a)	61.	(c)	62.	(c)	63.	(d)
64.	(a)	65.	(b)	66.	(d)	67.	(d)	68.	(a)	69.	(c)	70.	(c)
71.	(a)	72.	(d)	73.	(d)	74.	(d)	75.	(a)	76.	(a)	77.	(d)
78.	(b)	79.	(a)	80.	(b)	81.	(b)	82.	(b)	83.	(c)	84.	(d)
85.	(b)	86.	(d)	87.	(c)	88.	(a)	89.	(d)	90.	(d)	91.	(b)
92.	(d)	93.	(d)	94.	(b)	95.	(d)	96.	(b)	97.	(d)	98.	(a)
99.	(d)	100.	(a)										

CHAPTER 4

FOOD SCIENCE

Introduction: We all need food to stay alive and healthy. The food materials are complex mixtures of chemical substances and only those chemical substances which when eaten, absorbed and metabolized by the body for the production of energy, promotion of growth, repair of tissues or regulation of these processes are termed foods. Science which deals with all the aspects of the nutrients of the food, quality and preservation, is called Food Science. The chemical components of the food which perform these functions are termed nutrients. Therefore, no material can be called a food till it contains at least one nutrient. Food is the prime necessity of life. The purpose of food is to provide fuel which when broken down by oxidation gives energy required for performing vital activities. Major food chemicals used are preservatives, colours, flavour enhances, antioxidants, stabilizers and sweeteners. These are used to give colour to food, enhance taste and increase their shelf life.

BALANCED FOOD

Food:

The food materials are complex mixture chemical substances and only those substances which when eaten and absorbed by the body for the production of energy, promotion of growth, repair of tissues of regulation of these processes are termed foods. The chemical component of the food which perform these functions are termed Nutrients. Therefore, no material can be called as food till it contains at least one nutrient. Different types of nutrients of food are discussed below:

NUTRIENT	SOURCE	FUNCTION IN BODY
Carbohydrates	Bread, Potatoes, Sugar	Provide Energy
Fats	Butter, Cheese	Provide Energy
Proteins	Meat, Fish, Eggs, Milk	Help in growth and repair
Minerals	Vegetables, Fruits	Control body processes
Water	Water, Fruits	Controls body processes
Vitamins	Fruits, Vegetables	Control body processes

(i) Carbohydrates:

These are organic compounds which contain carbon, hydrogen and oxygen. They provide about half of the required energy and thus maintain the temperature of the body. Typical examples include the sugars, glucose and sucrose and the polysaccharides, starch and cellulose. Oxidation of carbohydrates gives carbon dioxide and water and liberates energy which is used by the body.

(ii) Fats:

Oils and fats are members of a larger group of naturally occurring compounds named Lipids. Chemically, oils and fats are triglycerides of fatty acids. They may have plant or animal origin. The fat has a higher caloric value as compared to carbohydrate and proteins. It has been established that consumption of saturated fats raises the level of cholesterol and triglycerides in the blood while the complete digestion of fatty foods produces glycerol and a mixture of long chain fatty acids.

(iii) Proteins:

Proteins are long chain organic compounds consisting of several different kinds of amino acids. They are rich in nitrogen. They are mainly responsible for growth. When digested by animals, proteins are hydrolyzed to the amino acids in the digestive system. There; degradation is brought about progressively by peptidases which are the hydrolyzing enzymes. The amino acids thus produced are absorbed into the blood stream and transported to the liver and various tissues in the body where they become involved in several processes.

(iv) Minerals:

These are inorganic materials present in the food. Vegetables and fruits are good sources of minerals. They help in growth and repair and control body processes. Calcium and phosphorous are the most abundant elements in the body. Apart from these, small amounts of several other trace elements are also found in the body, which are also essential to human life like Magnesium, Sodium, Potassium, Iron, Iodine and Chlorine.

(v) Water:

The human body contains about 65% water in various forms. It is essential for all metabolic processes. It helps in growth and repair and controls the body processes.

(vi) Vitamins:

These are also organic substances which are essential for the growth of the body and are required in small amounts. Fruits and vegetables are good sources of vitamins. They control body processes. Vitamins may be water soluble or fat soluble. Important vitamins are A, B, (B_1, B_2, B_6, B_{12}), C, D, E, and K. Each of them performs definite functions.

VITAMINS

Introduction:

Vitamins are specific organic compounds necessary for normal metabolic functions of the human body. These cannot be synthesised by the body in adequate amounts. Although they are needed only in traces but they must be included in the diet. The body's requirement for vitamins may vary considerably, depending upon age, sex, physical activity, diet, metabolic rate, state of health, drug therapy, individual habits and other factors affecting vitamin absorption, utilization and excretion. Absence or shortage of a vitamin results in a vitamin deficiency disease.

Classification of Vitamins:

The vitamins are divided into two broad categories, the fat-soluble group, including A, D, E, K and the water-soluble group, made up of the B complex and C.

CATEGORIES OF VITAMINS

Fat Soluble Vitamins		Water Soluble Vitamins	
Vitamin A		B_1 B_6 B_{12}	**Milk, meat, green leafy vegetables, Cereal grain**
Vitamin D	Fish liver oil.		
Vitamin K	Spinach, green leafy vegetables.	Vitamin C	
Vitamin E	Wheat germ oil green vegetable, egg yolk, meat bread, dried beans.		

Categories of Vitamins and Specific Functions of Vitamins:

Vitamin A:

Vitamin A is the member of alcohol family of high molecular weight that is stored in the liver. Plants make a class of coloured compounds called carotenoid pigments. Four of these can be converted into vitamin A by animals. These are also called a pro-vitamins or vitamin soluble in fats and fat solvents. It is necessary for normal function and structure of all epithelial cells and for the synthesis of visual purgle in the retinal rods of the eye hence for vision in dim light.

Actually vitamin A itself is quite rare in foods; therefore most is derived from carotene bearing plant sources. Carotene is present in green leafy vegetables and yellow fruits. Milk, butter, egg, fish and liver oil are good sources of vitamin A. The recommended daily allowance is from 4000 IU to 5000 IU. Deficiency of vitamin A causes dryness of the skin, tunnel vision and night blindness. Many children in developing countries are permanently blinded by vitamin A deficiency. Vitamin A can be stored as an ester in the liver of adults, while an adequate diet, can store several years supply in this form. Small children, without such reserves, are particularly susceptible to diseases. Mega doses of vitamin A can be toxic, β-carotene can possibly act as cancer inhibitor.

Vitamin D

The Sunshine Vitamin:

Vitamin D is the generic name for a family of about 10 sterols. The two most important of these sterols are Ergocalciferol (Vitamin D2) and cholecalciferol (Vitamin D3). The human body can synthesize provitamin of D3 (7-dehydrocholesterol), which can be converted photo-chemically to vitamin D3 by ultraviolet irradiation of the skin. Vitamin D increases the utilization of calcium and phosphorous by the body. Deficiency in infants and growing children can result in abnormal bone formation, a condition known as Rickets. Natural sources of Vitamin D include liver, fish, liver of fish-eating animals, egg yolk and butter. The deficiency of Vitamin D can also cause parathyroid disorders. Too much vitamin D can cause pain in the bones, nausea, diarrhoea, and weight loss.

Vitamin E:

There are several compounds with vitamin E activity and these are called tocopherols: the most potent of these are alphatocopherol. The tocopherols belong to the family of phenols which are antioxidants. Vitamin E is a natural antioxidant that plays a role in the normal physiology of animal bodies. It slows down the oxidative damage done to the human cells by the free radicals. Vitamin E scavenges free radicals. In this way, it can act as anti-aging agent. Vitamin E scavenges free radical reactions which are culprits behind the progressive cellular damage that results in the diseases and death that accompany at an advancing age. It promotes oxygenation, which is the healthful use to oxygen for respiration, while limiting oxidation, the harmful rusting of cells caused by free radicals. It also prevents fats and oils from turning rancid, and oxidizes fats and oils and is thought to be a cause of colon and breast cancer. Food sources which are rich in vitamin E are green leafy vegetables, beans and wheat grains.

Vitamin K

The Blood Clotter:

Chemically, vitamin K has a fused ring system and belongs to Quinone family. Many compounds can have vitamin K activity. Vitamin K is necessary for the formation of prothrombin, one of the enzyme precursors involved in blood clotting. Deficiency of Vitamin K will increase the time required for clotting of the blood. Good sources of vitamin K are spinach and other green leafy vegetables. It is also insoluble in water but soluble in fats and fat solvents.

Vitamin B:

The B Complex: Actually, there is nothing like Vitamin B alone. What was once called vitamin B has long since been recognized as a complicated mixture of organic compounds. The term B complex is now used to designate a group of water soluble vitamins found together in many food sources. Member of the B-Complex are:

The B complex vitamins are water soluble. The body has a very limited capacity to store water soluble vitamins. Water soluble vitamins must be taken in at frequent intervals. Deficiency of vitamin B can cause beriberi, dermatitis and pellagra.

MEMBERS OF THE B COMPLEX OF VITAMINS	
Name	**Sources**
B_1 Thiamine	Milk, nuts, cream of cereal grams
B_2 Riboflavin	Milk, red meat, wheat flour
Niacin, B3	Red meat, liver, Turnip greens, yeast
B_6 Pyridoxal	Eggs, liver, peas, beans, milk
B_5 Pantothenic acid	Liver, eggs, yeast, milk
Biotin	Beef liver, peanut, yeast, milk
Folic acid	Liver, kidney, mushroom, green leafy vegetables
B_{12} Cyanocobalamine	Liver, meat, eggs, fish

Vitamin C: *(Ascorbic Acid)*

Ascorbic Acid: It is also a water-soluble vitamin. Severe deficiency results in scurvy, a condition characterised by thin, porous bones, sore and bleeding gums, and a pronounced muscular weakness. Rich sources of vitamin C are citrus fruits, tomatoes, green peppers and strawberries.

Collagen is a substance that gives elasticity to the skin, cell and muscles. If our bodies are deficient in vitamin C, it soon becomes apparent in skin toning, bad health, sagging loose tissue, dropping muscles and premature aging. Vitamin C is also necessary for the utilization of iron. Vitamin C is not only good for the body and its iron and collagen, but it is also a preventer of infectious diseases. Vitamin C is also called as Skin Food.

In 1970, Linus Pauling, Winner of two Nobel Prizes, suggested that this vitamin could be used as a weapon against the common cold.

Vitamin C is also richly supplied to our brains. The vitamin is depleted by stress, tobacco smoking, alcohol, physical trauma, burns, anxiety, antibiotics, cortisones, sulpha drugs and contraceptive pills. It is the most unstable vitamin and easily lost during cooking and food storage.

FOOD NUTRIENTS

Sr. No.	FOOD (FRUITS)	MAJOR NUTRIENTS	CALORIE COUNTER KILO CALORIES 100 gm
1.	Apple	Carbohydrates, Minerals, Vitamins, Fiber	47
2.	Apricot	Carbohydrates, Minerals, Vitamins (C,B), Fiber	28
3.	Avocado	Fat, Protein, Minerals, Vitamins (A,E,C)	88
4	Banana	Carbohydrates, Minerals, Vitamins (C,B), Fiber	77
5.	Cherries	Carbohydrates, Minerals, Vitamins, Fiber	40
6.	Dates	Proteins, Carbohydrates, Minerals, Vitamins (C,B), Fiber	248
7.	Fig	Carbohydrates, Minerals, Vitamins (A.C.B), Fiber	41
8.	Grapes	Carbohydrates, Minerals, Vitamins (C,B,A)	51
9.	Grapefruit	Carbohydrates, Minerals, Vitamins (C,B,A)	22
10.	Lemon	Carbohydrates, Minerals, Vitamins (C,B), Fiber	15
11.	Mango	Carbohydrates, Minerals, Vitamins (C,B), Fiber	74
12.	Orange	Carbohydrates, Minerals, Vitamins (C,B)	35
13.	Papaya	Carbohydrates, Minerals, Vitamins (C,B), Fiber	28
14.	Pomegranate	Carbohydrates, Minerals. Vitamins (C,B), Fiber	44
15.	Peaches	Carbohydrates, Minerals, Vitamins, Fiber	37
16.	Pears	Carbohydrates, Minerals, Vitamins, Fiber	46
17.	Pineapple	Carbohydrates, Minerals, Vitamins, Fiber	46

18.	Plums	Carbohydrates, Minerals, Vitamins, Fiber	38
19.	Prunes	Carbohydrates, Minerals, Vitamins, Fiber	161
20	Raisins	Carbohydrates, Minerals, Vitamins (C,B). Fiber	247
21.	Raspberries	Carbohydrates, Vitamins, Fiber	25
22.	Strawberries	Carbohydrates, Vitamins, Fiber	25
23.	Tangerines	Carbohydrates, Minerals Vitamins, Fiber	34

CALORIE COUNTER

Dairy Products

FOOD	KILO CALORIES/ 100G	FOOD	KILO CALORIES/ 100G
Egg omelet	172	Egg fried	239
Cream double	462	Yogurt whole milk	62
Cream single	219	Milk dried whole	530
Butter Milk Fluid	36	Milk Skimmed	35
Butter Milk Dried	385	Milk human early	68
Milk Fresh	66	Yogurt low fat natural	54

Cereals and Cereal Food

Food	Kilo Calories/ 100g	Food	Kilo Calories/ 100g
Biscuits cream crackers	447	Biscuits plain, mixed	435
Rusks	409	Bread brown	242
Bread white	243	Custard powder	354
Rice polished	361	Flour self rising	350
Corn flour	354	Macaroni raw	360

Meat and Poultry

Food	Kilo Calories/ 100g	Food	Kilo Calories/ 100g
Chicken muscle raw	115	Beef frozen	151
Liver raw	143	Beef fried	273
Liver ox	284	Chicken roasted	189
Mutton fried	512	Heart sheep	239
Mutton raw	187	Kidney sheep	98
Mutton leg roasted	292	Mutton scrag and neck	245

Fruits

Food	Kilo Calories/ 100 g	Food	Kilo Calories/ 100g
Apples flesh only	47	Apple with skin and core	35
Dates fresh	248	Dates dried	272
Gapes black as whole	51	Grapes white as whole	60
Pears fresh	40	Raspberries raw	25
Bananas with skin	77	Cherries fresh	40
Strawberries fresh	26	Lemons whole fruit	15
Pineapple fresh	46	Orange fresh	35
Melons fresh	24	Pear with core	30

Nuts

Food	Kilo Calories/100 g	Food	Kilo Calories/ 100g
Almonds kernel	598	Peanuts kernel	603
Coconut fresh	364	Peanuts roasted and salted	582

Vegetables

Food	Kilo Calories/100 g	Food	Kilo Calories/ 100g
Mushroom	07	Onion	23
Carrot	23	Cabbage	20
Cucumber	09	Peas	64
Potatoes	80	Pumpkin	15
Radish	15	Spinach	26
Tomatoes	14	Turnip	18

Fats and Oil

Food	Kilo Calories/100 g	Food	Kilo Calories/ 100g
Olive oil	926	Margarine	792
Cod liver oil	926	Oil corn, nuts, sunflower	921

ROLE OF TRACE ELEMENTS IN THE BIOLOGICAL SCIENCES

MAJOR NUTRIENTS

Some Known Roles and Functions

Nitrogen	Components of proteins, nucleic acids, coenzymes, chlorophy!ls
Phosphorus	Component of nucleic acids, phospholipids, ATP

Potassium	Activation of enzymes, major role in maintaining water-solute balance and thus affecting osmosis
Calcium	Roles in cementing cell wall, regulation of many cell functions
Magnesium	Component of chlorophylls; activation of enzymes
Sulphur	Component of most proteins, two vitamins
Chlorine	Role in root, shoot growth; role in photolysis
Iron	Roles in chlorophyll synthesis, electron transport
Boron	Roles in flowering germination, fruiting, cell division, nitrogen metabolism.
Manganese	Role in chlorophyll synthesis ; coenzyme activity
Zinc	Role in formation of auxin, chloroplasts, and starch; enzyme component
Copper	Component of several enzymes
Molybdenum	Component of enzyme used in nitrogen metabolism.

QUALITY OF FOOD

The quality of food is determined by the bioavailability of nutrients, appearances texture and flour. It further depends upon of what kind of additives, preservatives and antioxidants are present in it. Moreover the quality of food is also indicated by the type of material used for packing as well as the way it is frozen.

Food Additives:

Food additives are substances which are added during the processing or making of that food and finally they become part of the food. Food additives are classified as direct and indirect.

Direct food additives:

Direct food additives are usually added during processing of the food to add nutrients, keep the product fresh or to make the food more appealing. Direct food additives may, be man-made or natural. Natural. Food additives include:

(i) Herbs or spices to increase flavour in the food.

(ii) Vinegar for pickiling foods.

(iii) Salt to preserve meat.

Indirect food additivies:

Indirect food additives, are substances that may be found in food during or after the food is processed. They were not used or placed in the food on purpose. These additives are usually present in small amounts in the find product.

Some main functions of the food additive are:

(i) To give a smooth and consistent texture to the food.

(ii) To prevent liquid products from separating by the use of emulsifiers.

(iii) To provide an even texture to the food with the help of stabilizers and thickeners.

(iv) To allow food substances to flow freely by adding anti-caking agents value.

(v) To provide colour and enhance flavour.

(vi) To bring out the taste of food by adding spices.

Fortification:

Many foods and drinks are fortified and enriched to provide vitamins minerals and other nutrients. This process is called fortification of the Food products. Examples of commonly fortified foods are flour, cereal, margarine and milk. This helps to make up for vitamins or minerals that may be low or lacking in a person's diet.

Flavour of foods:

Flavour is the sensory impression of a food or other substances and it is determined mainly by the chemical senses of taste and smell. The "Trigeminal Senses" which detect chemical irritants in the mouth and throat, may also occasionally determine flavour. The flavour of the food as such, can be altered with natural or artificial flavoruants, which affect these senses. Smell is the main determent of a food item's flavour out of the three chemical senses.

Flavourants

Due to the high cost or unavailability of the natural flavour extracts, most commercial flavourants are nature-identical, which means that they are the chemical equivalent of natural flavours but chemically synthesized rather than being extracted from the source materials. Artificial flavourants are often formulated with the same chemical compounds found in natural flavourants.

Smell flavourants or simply, flavourants are engineered in similar ways as with industrial fragrances and perfumes. Some typical flavoured used in foods are given below:

Chemical	Odor
Diacetyl	Buttery
Isoamyl acetate	Banana
Cinnamic aldehyde	Cinnamon
Ethyl propionate	Fruity
Limonene	Orange
Ethy-(E, Z) 2, 4-decadienoate	Pear
Allyl hexanoate	Pineapple
Ethyl maltol	Sugar, Cotton candy
Methyl salicylae	Wintergreen
Benzaldehyde	Bitter almond

Taste of Foods:

While salt and sugar can technically be considered flavourants that enhance salty and sweet tastes. But usually only compounds that enhance umami, as well as other secondary flavours are considered taste flavourants. Artificial sweetners are also technically flavourants

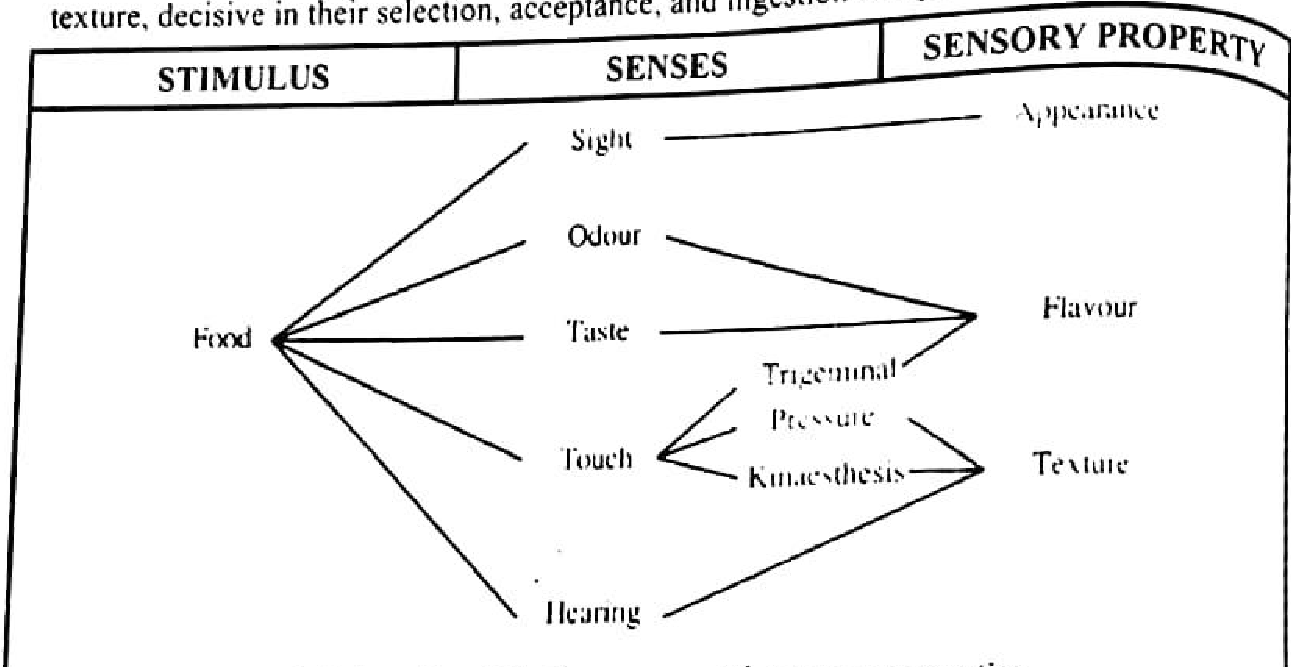
Umami or savory flavourants, more commonly called "taste enhancers" are largely based on Amino acids and Nuclootides. These are manufactured as sodium or calcium salts. Glutamic acid and glycine salts are common umami flavourants.

Certain organic acids can be used to enhance sour tastes, but like salt and sugar these are usually not considered and regulated as flavourants under law. Each acid imparts a slightly different sour or tart taste that alters the flavour of food.

- *Acetic acid:* gives vinegar its sour taste and distinctive smell
- *Citric acid:* found in citrus fruits and gives them their sour taste
- *Lactic acid:* found in various milk products and give them a rich tartness
- *Malic acid:* found in apples and gives them their sour/tart taste
- *Tartaric acid:* found in grapes and wines and gives them a tart taste

Appearance, Texture and Flavour of Foods

Appearance, texture and flavour of foods collectively determine the quality of food. Consumers consider all the three main sensory properties namely, appearance, flavour and texture, decisive in their selection, acceptance, and ingestion of a particular food.



Relationship of the five senses with sensory properties.

We are all familiar with the basic five senses: sight (eyes), taste (tongue), odour (nose), hearing (ears) and touch (fingers, mouthfeel). The sense of touch, giving mouthfeel, can be broken down into three sensations: pressure, trigeminal and kinaesthesis. Pressure represents the feeling when force is applied over the surface of the food, trigeminal refers to a pain sensation and kinaesthesis denotes feedback from masticatory muscles during chewing.

PRESERVATIVES AND FOOD DETERIORATION

Foods deteriorate when kept in an unprocessed form. An important factor responsible for food spoilage is the attack by microorganisms like moulds, yeasts, and bacteria. Several foodstuffs like milk are good growth media for these microorganisms and moist food when stored in a warm place goes bad because of their rapid multiplication.

Microorganisms are present in air, dust, soil, sewage and on the hands. One of the ommonest food spoilage organisms is *mesophilic bacteria*, originating in warm blooded nimals, however, they are also present in soil, water and sewage. These bacteria grow ound the normal body temperature *i.e.*, 30-4CPC. To keep food in good condition, the owth of microorganisms is to be prevented by killing them. Among the methods used to eserve food, the following may be listed:

1. Use of chemicals
2. Dehydration
3. Sterilization by heat
4. Use of low temperatures
5. Irradiation.

Use of Chemicals:

Use of chemicals has been made to preserve foods for several centuries. Some of the ditional preservatives are sodium chloride, sugars, vinegar, and alcohol. Strong sugar lution has a preservative action as seen in the case of jams. Condensed sweetened milk ntains a large excess of sugar and provides another example when sugar acts as a eservative. Micro organisms cannot survive in concentrated sugar solutions because water sses from the cells of the micro-organisms to the solution which brings about dehydration d it results in the death of the micro-organisms. The same concept is used for the eservation of meat by CURING involving the use of mixture of salt salt petre and metimes a small amount of sugar.

Use of Sulphur Compounds:

Among the chemicals which are used as food preservatives mention may be made of lfur dioxide or potassium metabisulphite, benzole acid, sorbic acid or the antibiotic nisin. Nisin is used as a preservative for cheese, cream and several canned foods. This antibiotic is oduced by some strains of the organism *Streptococcuslactis* and occurs naturally in milk. Nisin is, however, effective against a limited range of organisms and therefore may not be garded as a general purpose food preservative. Nisin is a polypeptide antibiotic and when ten by man, is digested without ill-effects in a way similar to other polypeptides.

Antioxidants:

Antioxidants have to be used in oils and fats to prevent rancidity. Vitamin E is good natural antioxidant. However, it occurs in insufficient quantities to prevent oxidative changes. Mention may be made of butylated hydroxyanisole (BHA) which is widely used as an antioxidant in several edible oils, fats, butter, essential oils and vitamin oil (vitamin A).

Some important antioxidants used in foods are

(i) Thiols
(ii) Ascorbic acid
(iii) Polyphenols
(iv) Vitamin A
(v) Vitamin E
(vi) Catalase
(vii) Superonide diammutase
(viii) Various peroxides

Dehydration

Dehydration is a good method of food preservation, since microorganisms need wate to grow and reproduce. Drying of fruits in the sun is the classical example of this method an a modem development employs freeze drying in which frozen food is dried under hig vacuum. Role of heat in the preservation of milk has been already mentioned, and irradiatio is a rather more recent method to kill microorganisms.

Packing of food:

Sometimes foods become harmful because of contamination from faulty packin materials. For example, if acid foods are mixed in galvanized iron containers, zinc metal ma pass in the food harmful quantities.

Why are foods preserved?

Preservation is usually defined as a method used to maintain an existing condition o to prevent damage likely to be brought about by chemical (oxidation), physical (temperature light) or biological (microorganisms) factors. Preserving food, made it possible to have food available from harvest to the next year. The main function of preservation is thus to delay the spoiling of foodstuffs and to prevent any alterations in their taste or, in some cases, their appearance. This can be done in different ways, through processing methods including canning, dehydration (drying), smoking and freezing; the use of packaging; and the use of food additives such as antioxidants or other preservatives. In this article we will focus on preservatives

The primary reason for using preservatives is to make foods safer by eliminating the influence of biological factors. The greatest threat to consumers is that of food being spoiled, or from becoming toxic by the effect of micro-organisms (e.g. bacteria, yeast, moulds) occurring in them. Some of these organisms can secrete poisonous substances ("toxins"), which are dangerous to human health and can even be fatal.

How are foods conserved, and what substances are used?

To delay the spoiling of foodstuffs by micro-organisms, anti-microbial substances are used which inhibit, delay or prevent the growth and proliferation of bacteria, yeasts and moulds.

Sulphur compounds such as the sulphites (E221-228) are used to inhibit the growth of bacteria e.g. in wine, dried fruits, vegetables in vinegar or brine, Sorbic acid (E200) can be used for many different purposes, including the preservation of potato products/ cheese and jam.

Another important group of substances consists of the nitrate and nitrite compounds (E249-252). These are used as additives in meat products such as sausages and hams to protect against the bacterium that causes botulism (Clostridium botulinum), and in this way they make a significant contribution to food safety. Benzoic acid and its calcium, sodium or potassium salts (E210-213) are used as anti-bacterials and anti-fungais in foods such as pickled cucumbers, low sugar jams and jellies, dressings, condiments.

Examples of widely used preservatives in the EU:

E-Number	Substance/class	Some foodstuffs in which they are used
E 200-203	Sorbic acid and sorbate compounds	Cheese, wines, dried fruit, fruit sauces, toppings
E 210-213	Benzoic acid, and benzoate	Pickled vegetables, low sugar jams and jellies, candied fruits, semi-preserved fish products, sauces
E 220-28	Sulphur dioxide and sulphite compounds	Dried fruits, fruit preserves, potato products, wine
E 235	Natamycin	Surface treatment of cheese and sausage
E-249-252	Nitrite and nitrate compounds	Sausage, bacon, ham, foie gras, cheese, pickled herring

Summary

Preservatives are still necessary to ensure the safety and variety of different foodstuffs available. They function through delaying the spoiling of foodstuffs and preventing any alterations in their taste or appearance. Their assessment and use in foodstuffs is tightly controlled at both the European and the international level.

Frozen Food Storage:

Foods can also be preserved by keeping them at low temperature in the frozen form. A lot of care needs to be taken in the storage of frozen food to maintain their quality and freshness. There are two basic points in handling the frozen food; one is quality material which should be used in its packing and maintenance of constant low temperature in the freezer. The following factors are important to maintain the quality of food in the frozen form.

(i) **Temperature**

Temperature is the most important factor for the frozen food. Frozen food needs to be kept in the freezer at 0 degrees F or below. Food that has been correctly prepared, packaged, and frozen will still be of low quality if it is not stored at this temperature. The quality of foods stored for one year at 0 degrees F is better than that of food stored for 5 month of at 5 degrees F or 2 months at 10 degrees F.

Nutritive Value, colour, flavor and texture of the food is affected when it is stored above 0 degrees F.

One needs to remember that frozen foods are greatly affected by temperature.

Length of Storage:

Storage time of the frozen food is also very important. One should always use the food that has been stored the longest. Length of storage for frozen quality food is different for different kinds of foods. The following guide lists the length of time foods will stay at top quality, appearance and flavor when stored at 0 degrees F or below. The times apply only to foods packaged in moisture-vapour-resistant freezer material, and the shorter storage period is better.

Length of Storage for Quality Food

	Months
MEATS	
Beef	
Liver, ground meat	3 – 4
Roasts, steaks	6
Lamb	
Chops	6 – 1
Ground meat	3 – 4
Roasts	6 – 9
Cicket, Turkey	6 – 12
Duck, Goose, Wild Game	3
Giblets of poultry, Turkey, Game	3
Shrimp, Crab meat, Oysters	3
Fish	6 – 9
VEGETABLES	6 – 9
FRUITS	6 – 12
COOKED FOODS	
Vegetables	3
Meats, Sauces, Stews	3
Rolls, Biscuits	3
Cakes, Cookies	3
Soup	3
UNCOOKED FOODS	
Fruit Pies	6
Sandwiches	3 weeks

Freezer Materials:

High quality moisture-vapour-resistant freezer material should be used in the packing of the foods to be frozen for storage. This material will hold moisture and food odours in and prevents stored foods from drying out. Container used in freezers should be those that will not puncture easily not break at 0 degree F or below. They should also be grease-proof and odourless.

Freezer aluminum is thicker and better than heavy-duty aluminum foil which is not moisture-vapour-resistant. Different grades of freezer paper can also be used. Freezer tap should be used instead of string to tightly seal the edges of paper. Polyethylene freezer bags should be used with cover boxes also help packages to freezer in a uniform shape which makes them easier to stack. Coffee cans and similar containers should only be used with plastic freezer bags inside.

Storage in Dry Ice:

Dry is frozen carbon dioxide gas at a temperature of −80°C. It is not converted into liquid on heating but instead it sublimes so it is non-melting cold ice. This is an excellent aterial used for the frozen foods which are to be kept for longer periods. Meat, meat roducts and ice cream boxes are best kept in dry ice compartments.

How long food will stay frozen depends on:

1. **Amount of food in the freezer.** A full freezer will stay cold much longer than a freezer only half full.
2. **Kind of food in the freezer.** A freezer full of meats will stay cold longer than a freezer full of baked food.
3. **Temperature of the freezer.** The colder the freezer was when it stopped, the longer food will stay frozen.
4. **Kind of freezer.** A well-insulated freezer will keep food frozen much longer than one with little insulation.
5. **Size of freezer.** The larger the freezer, the longer the food will stay frozen.

ADULTERATION OF FOOD

INTRODUCTION:

"Adulteration" is a legal term meaning that a food product fails to meet federal or ate standards."

By International standards food is "adulterated" if it meets any one of the following criteria:

(1) it bears or contains any "poisonous or deleterious substance" which may render it injurious to health;

(2) it bears or contains any *added* poisonous or *added* deleterious substance (other than a pesticide residue, food additive, color additive, or new animal drug, which are covered by separate provisions) that is unsafe;

(3) its container is composed, in whole or in part, of any poisonous or deleterious substance which may render the contents injurious to health; or

(4) it bears or contains a pesticide chemical residue that is unsafe.

(5) it is, or it bears or contains, an unsafe food additive;

(6) it is, or it bears or contains, an unsafe new animal drug;

(7) it is, or it bears or contains, an unsafe color additive;

(8) it consists, in whole or in part, of "any filthy, putrid, or decomposed substance" or is otherwise unfit for food; or

(9) it has been prepared, packed, or held under unsanitary conditions (insect, rodent, or bird infestation) whereby it may have become contaminated with filth or rendered injurious to health.

Further, food is considered adulterated if:

(10) it has been irradiated and the irradiation processing was not done in conformity with a regulation permitting irradiation of the food in question.

(11) it contains a dietary ingredient that presents a significant or unreasonable risk of illness or injury under the conditions of use recommended in labeling (for example, foods or dietary supplements containing aristolochic acids, which have been linked to kidney failure, have been banned.);

(12) a valuable constituent has been omitted in whole or in part or replaced with another substance; damage or inferiority has been concealed in any manner;

or a substance has been added to increase the product's bulk or weight reduce its quality or strength, or make it appear of greater value than it is (this is "economic adulteration")

Economic Adulteration

A food is adulterated if it omits a valuable constituent or substitutes another substance, in whole or in part, for a valuable constituent (for instance, olive oil diluted with tea tree oil); conceals damage or inferiority in any manner (such as fresh fruit with food coloring on its surface to conceal defects); or any substance has been added to it or packed with it to increase its bulk or weight, reduce its quality or strength, or make it appear bigger or of greater value than it is (for example, scallops to which water has been added to make them heavier).

10 Common Food Products Prone to Adulteration

Milk
Saffron
Seafood
Ice-Cream.
Olive oil.
Orange juice
Flour
Honey
Coffee
Fries.

ADULTERANT IN FOOD

S. No.	Adulterant	Food commonly involved	Disease or Health effect
Adulterant in food			
1	Foreign leaves or exhausted tea leaves, saw dust artificially coloured	Tea	Injurious to health, cancer
2	Rancid oil	Oils	Destroys vitamin A and E
3	Sand, marble chips, stones, filth	Food grains, pulses etc.	Damage digestive tract
Chemical Contamination			
4	Mineral oil (white oil, petroleum fractions)	Edible oils and fats, Black pepper	Cancer
5	Lead chromate	Turmeric whole and powdered, mixed spices	Anemia, abortion, paralysis, brain damage
6	Arsenic	Fruits such as apples sprayed over with lead arsenate	Dizziness, chills, cramps, paralysis, death
7	Cadmium	Fruit juices, soft drinks, etc. in contact with cadmium plated	'Itai-itai (ouch-ouch) disease, Increased
		vessels or equipment. Cadmium contaminated	Salivation, acute gastritis, liver and kidney damage, prostrate cancer

		water and shell-fish	
8	Lead	Water, natural and processed food	Lead poisoning (foot-drop, insomnia, anemia, constipation, mental retardation, brain damage)
	Bacterial contamination		
9	Bacillus cereus	Cereal products, custards, puddings, sauces	Food infection (nausea, vomiting, abdominal pain, diarrhoea)
10	Shigella sonnei	Milk, potato, beans, poultry, tuna, shrimp, moist mixed foods	Shigellosis (bacillary dysentery)
11	Monosodium glutamate (flour) (beyond safe limit)	Chinese food, meat and meat products	Brain damage, mental retardation in infants
	Fungal Contamination		
12	Aflatoxins	Aspergillus flavus-contaminated foods such as groundnuts, cottonseed, etc.	Liver damage and cancer
	Natural Contamination		
13	Flouride	Drinking water, sea foods, tea, etc.	Excess fluoride causes fluorosis (mottling of teeth, skeletal and neurological disorders)
14	Oxalic acid	Spinach, amaranth, etc.	Renal calculi, cramps, failure of blood to clot
15	Nitrates and Nitrites	Drinking water, spinach rhubarb, asparagus, etc. and meat products	Methaemoglobinaemia especially in infants, cancer and tumours in the liver, kidney, trachea oesophagus and lungs. The liver is the initial site but afterwards tumours appear in other organs.
16	Antibiotics (beyond safe limit)	Meats from antibiotic-fed animals	Multiple drug resistance hardening of arteries, heart disease

METHODS OF FOOD PRESERVATION

Food preservation involves preventing the growth of bacteria, fungi (such as yeasts), or other micro-organisms (although some methods work by introducing benign bacteria or fungi to the food), as well as retarding the oxidation of fats that cause rancidity. Food preservation may also include processes that inhibit visual deterioration, such as the enzymatic browning reaction in apples after they are cut during food preparation.

Many processes designed to preserve food will involve a number of food preservation methods. Preserving fruit by turning it into jam, for example, involves boiling (to reduce the fruit's moisture content and to kill bacteria, etc.), sugaring (to prevent their re-growth) and sealing within an airtight jar (to prevent recontamination). Some traditional methods of preserving food have been shown to have a lower energy input and carbon footprint, when compared to modern methods.

Maintaining or creating nutritional value, texture and flavor is an important aspect of food preservation, although, historically, some methods drastically altered the character of the food being preserved. In many cases these changes have come to be seen as desirable qualities cheese, yogurt and pickled onions being common examples.

1. Drying
2. Cooling
3. Freezing
4. Heating
5. Salting
6. Sugaring
7. Smoking
8. Pickling
9. Lye
10. Canning
11. Jellying
12. Jugging
13. Burial
14. Curing
15. Fermentation

Industrial/Modern Techniques

1. Pasteurization
2. Vacuum packing
3. Artificial food additives
4. Irradiation
5. Pulsed electric field elcctroporation
6. Modified atmosphere
7. Non-thermal plasma
8. High-pressure food preservation
9. Bio preservation
10. Hurdle technology

MULTIPLE CHOICE QUESTIONS

HEALTH

1. Hygiene is defined as that discipline of science which deals with healthful living and is derived from the word Hygiea (Greek goddess of health); a healthy person is one who is well balanced physically, mentally and socially. Which of the following sciences is closest to Hygiene?
   - (a) Natural Sciences
   - (b) Chemical Sciences
   - (c) Biological Sciences
   - (d) Physical Sciences.
2. Hardness of water is a property which is attributable to soluble salts of alkaline earths — calcium and magnesium. Hard water is not useful for drinking, washing , cooking and dyeing purposes. The hardness is measured in degrees in the English Scale (dark's Scale-grains of calcium carbonate / Imperial gallon). Water under 4 degrees of hardness is considered as soft. Above what degree, it is considered as hard?
   - (a) 5
   - (b) 6
   - (c) 8
   - (d) 12
3. Household purification of water can be done by boiling, filtration, proper storage or chemical disinfection. What chemical is most commonly used for disinfecting water?
   - (a) Bleaching powder
   - (b) Potassium permanganate
   - (c) Chlorine tablets
   - (d) All the above.
4. BCG vaccination produces immunity and plays an effective role in the control of tuberculosis. The BCG Vaccine consists of live strain of attenuated bovine tubercle bacilli. The level of protection is about 80%. About how long the immunity lasts,
   - (a) 2-4 years
   - (b) 4-6 years.
   - (c) 6-8 years
   - (d) 8-10 years.
5. About how many people die every year by Malaria in this World?
   - (a) One million
   - (b) One thousand
   - (c) Fifty thousand
   - (d) One hundred thousand.
6. Ventilation means the constant replacement of foul air by fresh air through inlets and outlets. It can be natural or mechanical. Which one of the following is not an example of mechanical ventilation?
   - (a) Exhaust Ventilation
   - (b) Wind
   - (c) Plenum Ventilation
   - (d) Air conditioning.
7. Infant mortality is the number of deaths of infants under one year of age for every thousand live births in the course of a year. What is the major cause of infant mortality?
   - (a) Respiratory diseases
   - (b) Malnutrition.
   - (c) Gastro-intestinal diseases
   - (d) All the above.
8. Proteins are tissue builders. They are important for the growth of the children Which one of the following is a plant source of proteins.
   - (a) Milk
   - (b) Egg

[redacted]

(c) Rice (d) Fish.

9. Anopheles mosquito is the mosquito responsible for the spread of Malaria. About how many species of this family are known?
(a) More than ten (b) More than twenty
(c) More than thirty (d) More than forty.

10. There are four stages in the life-cycle of a mosquito. Which stage is the last one?
(a) Adult (b) Pupae
(c) Larvae (d) Eggs

11. Public health and family planning go side by side. There are various methods of contraceptions. Which one of the following method involves male organs?
(a) Condom (b) Diaphragm
(c) Foam tablet (d) Jelly

12. Droplet infection is one of the types of transmission of infection through air-born process. Identify one such process.
(a) Sneezing (b) Coughing
(c) Laughing and Talking (d) All the above.

13. Overfeeding or over nutrition is the pathological state resulting from the consumption of excessive quantity of food over an extended period of time. Overfeeding causes diseases. Which one of the following diseases is more concerned with body-weight?
(a) Hypertension (b) Renal diseases
(c) Obesity (d) Diabetes mellitus.

14. Hygiene may be defined as the science and art of preserving and improving health. It embraces all factors which contribute to healthy living and preventing disease either in the individual or in the community. Which one of the following branches of Hygiene is concerned with sex problems?
(a) Mental Hygiène (b) Industrial Hygiene
(c) Social Hygiene (d) General Hygiene

15. "Vitamin 'C' can prevent cold" — it was claimed by whom?
(a) Paul Muller (b) Linus Pauling
(c) Marie Curie (d) Henry Becquerel.

16. Riboflavin was discovered in milk as early as 1879. It was so named because of the similarity of parts of its structure to that of sugar ribose and because of its relation to the general group of flavins which possess fluorescent properties. Riboflavin belongs to which member of Vitamin family?
(a) Vitamin D (b) Vitamin K
(c) Vitamin B (d) Vitamin A.

17. The deficiency of this vitamin causes diseases like Angular Stomatilis, Dyssebacea, Cheilosis and Glossitis. Name it.
(a) Vitamin B (b) Vitamin C
(c) Vitamin D (d) Vitamin K.

18. Gingivitis is the disease of bad odour. It relates to which part of the human body?
(a) Armpit (b) Foot

(c) Mouth
(d) Nose.

19. Dry ice is used for storing food at low temperatures for longer periods. What is the nature of dry ice?

(a) Frozen water
(b) Solidified carbon doixide.
(c) Liquid Hydrogen
(d) Natural ice.

20. The term "Antibiosis" was coined by Vuillemin in 1889. Using the example of a lion killing and eating its prey, he described the lion as "Antibioto", its prey as a "support" and term was intended to apply to any destructive action of an individual of one species against the course of what Darwin called:

(a) The struggle for existence
(b) The struggle for resistance
(c) The struggle for evolution
(d) The struggle for replication.

21. Leprosy is a chronic infectious disease. Symptoms are thickening of the skin. The mode of transmission is unknown but probably involves prolonged exposure in childhood. The disease is endemic in tropical and subtropical Asia, Africa, Central and South America and the Pacific region and the southern U.S.A. Leprosy is caused by:

(a) Mycotuberculosis
(b) Mycobacterium Leprae
(c) Bacillus
(d) By all the above.

22. Cyanide is a powerful poison and it causes immediate death. What is the biochemistry of cyanide poisoning?

(a) Cyanide — hermoglobin complex formation.
(b) Cyanide combination with the blood red cell.
(c) Cyanide inhibiting cyctochroine oxidase.
(d) Cyanide inhibiting myoglobin.

23. Carbohydrates are very important nutrients of food. Polysaccharide is a class of carbohydrates. Which of the following polysaccharide is not a polymer of glucose.

(a) Amy lose
(b) Inulin
(c) Glycogen
(d) Amylopectin.

24. Starch and Glycogen are both polymers of:

(a) Fructose
(b) Glucose
(c) Mannose
(d) Sorbose.

25. Soaps are characterised best by which of the following statements:

(a) These are responsible for the hardness of water.
(b) These are anionic detergents.
(c) These are hydrophobia but not hydrophilic
(d) These increase surface tension of water.

26. "Antibiotics if rightly prescribed kill the disease but if wrongly prescribed kill the patient". What is the message in this statement for a physician and a patient?

(a) Antibiotics kill all kinds of pathogens
(b) Antibiotics are very dangerous.
(c) Antibiotics are powerful medicines.

(d) Antibiotics have specific properties, are toxic and should be used with a lot of care.

27. Disgestive system metabolises proteins into amino acids, and carbohydrates into glucose. What is fat metabolised into?

(a) Inorganic acids (b) Weak acids
(c) Fatty acids (d) Strong acids.

28. Natural whole-milk yougurt is made with live Bifidus Acidophilus cultures, believed to aid digestion and dietary balance. Yougurt is big source of.

(a) Magnesium (b) Calcium
(c) Sodium (d) Phosphorous

29. Incubation period is defined as the time interval between the entry of the disease and the onset of clinical manifestation of the disease. During the incubation period, the disease agent undergoes multiplication in the body of the suseptible host, the length of duration of the incubation period-is a characteristic of each disease. What is the incubation period for typhoid fever?

(a) 14 days (b) 10 days
(c) 8 days (d) 6 days

30. Milk is the secretion of mammary glands. It is the best and most complete of all foods as it contains all the food factors needed for the growth and maintenance of health. Due to this fact it is the only diet for children upto the age of ________

(a) 8-months (b) 10-months
(c) 14-months (d) 18-months

31. Milk is complete food for all age groups because of its unique nutritive value. Milk proteins posses high biological value. Which of the following proteins is found in milk?

(a) Casein (b) Lactalbumin
(c) Lactglobulin (d) All the above

32. Disinfectants are those substances which destroy pathogenic organisms. All disinfectants are classified as natural physical or chemical. Which of the following is not an example of physical disinfectants?

(a) Dry heat (b) Sunlight
(c) Boiling (d) Steaming

33. Immunisation is a method in which the resistance of the human body is increased against the communicable diseases. What is the best time for BCG Vaccine?

(a) 0-1 month (b) 1-2 month
(c) 2-3 month (d) 3-4 month.

34. The World Health Organisation is a specialised non-political health agency of the United Nations, with headquarters at Geneva. When was its constitution drafted?

(a) 1942 (b) 1945
(c) 1943 (d) 1944

35. Which one of the following is a principal organ of the World Health Organisation?

(a) The World Health Assembly (b) The Executive Board.

(c) The Secretariat
(d) All the above.

36. UNICEF — United Nations International Children's Emergency Fund is one of the specialised agencies of the United Nations. It also assists in the field of Health UNICEF is governed by an Executive Board of how many nations?

(a) Ten
(b) Twenty
(c) Thirty
(d) Forty.

37. Milk is an efficient vehicle for a great variety of disease agents. Which of the following is not a milk born disease?

(a) Brucellosis
(b) Rickets
(c) Arthrax
(d) Streptomycosis.

38. A sample of good milk should be opaque, off-white colour, without any peculiar taste or smell. Fresh milk is amphoteric due to probably acid phosphates of alkalies. What should be the specific gravity of the pure milk?

(a) From 1011 to 1018.
(b) From 1027 to 1034
(c) From 1020 to 1025
(d) From 1035 to 1044.

39. Pasteurisation is a preventive measure of public health importance and corresponds in all respects to the modern principles of safe supply of milk. It is the simplest cheapest and most trustworthy method of rendering milk safe. Which one of the following processes is widely used for the pasteurisation of milk.

(a) Holder Process
(b) High Temperature Short Time (HTST) Process.
(c) Both (a) and (b)
(d) Neither (a) nor (b)

40. Which one of the following diseases is not caused by mosquitoes?

(a) Malaria
(b) Filaria
(c) TB
(d) Yellow fever.

41. Plague is an acute specific febrile communicable disease caused by Pasteurella Pestis and transmitted to man by the bite of infected rat fleas. In which of the following varieties it occurs in man?

(a) Babonic Plague
(b) Pneumonic Plague
(c) Septicaemic Plague
(d) All the above.

42. Diet is the food intake over a period. Which of the following diet does not include any food from animal sources?

(a) Carnivorous diet
(b) Vegan diet
(c) Vegetarian diet
(d) Omnivorous diet.

43. Energy value of a food is determined by combustion or burning a known quantity in a food calorimeter and is measured in kilojoules per gram. Which of the following nutrients of food gives the highest energy?

(a) Carbohydrates
(b) Proteins
(c) Fats
(d) Minerals.

44. Which one of the following is not high energy value foods?

(a) Dried fruit
(b) Nuts

(d) Fruit Juices (d) Cereals.

45. Which one of the following is zero energy value food components?
(a) Minerals (b) Vitamins
(c) Dietary fibres (d) All the above

46. Food can be preserved by various methods. Which of the following methods of preservation of food requires removal of water preventing pathogen growth?
(a) Refrigeration (b) Radiation
(c) Dehydration (d) Heating.

47. Food preservation by Dehydration process can be done by various methods. Which of the following method is used for the preservation of herbs and spices.
(a) Spray drying (b) Vacuum drying
(c) Freeze drying (d) Tunnel drying.

48. Immunization protects children against some of the most dangerous diseases of childhood. A child is immunized by vaccines which are injected or given by mouth. The vaccines work by building up the child's defences. What is the right age of a baby for immunization against measles?
(a) 7 months (b) 8 months
(c) 9 months (d) 10 months.

49. The right combination of foods is a principle of great importance, both in sickness and also as a preventive measure. One of the most essential points in the combination of foods is to supply or ration well-balanced in acid and base forming elements. Which of the following is unfavourbale combinations for the best digestive work?
(a) Large quantities of milk and sugar.
(b) Cooked fruits with sugar and milk
(c) Too many kinds of food at one meal.
(d) All the above.

50. Proteins are essential nutrients of foods, proteins are made up simpler substances called amino acids. How many amino acids are used in making proteins?
(a) 14 (b) 16
(c) 20 (d) 18

51. Although twenty amino acids are known but of them eight cannot be manufactured in our body in sufficient quantity and hence have to be supplied from outside. These 8 amino acids are called essential amino acids?
(a) Lysine (b) Tryptoplan
(c) Leucine (d) Histidine

52. All the proteins are not of equal quality. These differ from each other in so many ways. Which of the following factors is used to know the quality of the proteins?
(a) Digestibility coefficient (b) Biological value.
(c) Protein efficiency ratio (d) All the above.

53. Which of the following nutrients of foods is richer source of energy at cheaper rate?
(a) Carbohydrates (b) Proteins
(c) Minerals (d) Vitamins

54. Vitamins are organic substances in food which are required in small amounts, but which cannot by synthesised in adequate amount. They do not yield calories but act as catalysts in various body processes. Vitamins are classified into Fat soluble and Water soluble. Which of the following vitamins is not soluble in fat?

(a) Vitamin A (b) Vitamin D.
(c) Vitamin C (d) Vitamin K.

55. Which of the following vitamins is not water- soluble?

(a) Vitamin C (b) Vitamin E
(c) Vitamin B2 (d) Vitamin B6

56. Which of the following diseases is not caused by the deficiency of Vitamin A.

(a) Night blindness (b) Xerophythalmia
(c) Rickets (d) Corneal Xerosis.

57. Wheat is a staple food in several parts of the world. Which of the following is its major parts?

(a) Starch (b) Gluten
(c) Water (d) Minerals.

58. Green leafy vegetables should always be included regularly in diet. They are rich in vitamins and minerals. Although low in calories they form roughage in our diet and are best to obese persons. What is the chemical nature of these vegetables?

(a) Acidic (b) Basic
(c) Neutral (d) Amphoteric.

59. Hypothalamus (Part of the brain) helps to regulate body temperature which may vary person to person or shift slightly at different hours of the day. At what minimum temperature, the human body feels feverish?

(a) 98°F (b) 99°F
(c) 100°F (d) 101°F

60. At what temperature the body suffers from Hypothermia—a condition when the person is abnormally cold?

(a) Below 95°F (b) Below 96°F
(c) Below 94° F (d) Below 93°F

61. At what temperature cell destruction occurs in the human body?

(a) 103°F (b) 104°F
(c) 105°F (d) 106°F

62. Aspirin is normally taken as an antipyretic and an analgesic but recently its more useful functions in the body have been discovered. Which one of the following is its special feature?

(a) Prevents heart attacks
(b) Reduces the risk of certain types of strokes.
(c) Prevents death from colon cancer.
(d) All the above.

63. Legumes are the dried seeds of pod-bearing leguminous plants. The size and type of pod determines the type of legume. Legumes are alternative proteins. Which of the following is an example of legumes?

(a) Black eye beans
(b) Click peas
(c) Lima beans
(d) All of the above

64. Most of us know of sesame as something sprinkled on breads and cereals or as ingredient in health confectionary. It is one of the oldest herbs known for its seeds. It is used as both food and as a flavouring. It has a range of applications. It is rich in:

(a) Carbohydrates
(b) Proteins
(c) Fiber
(d) Water.

65. Fruits are one of the oldest forms of food known to man. Fruits have highly beneficial effect on the human system. Fruits are good sources of vitamins. To what physiological actions of fruits this corresponds to:

(a) Diuretic effect
(b) Alkalinising effect
(c) Laxative effect
(d) Tonic action

66. Apples are invaluable in the maintenance of good health and in the treatment of many ailments. It was said long ago, "to eat an apple before going to bed will make the doctor beg his bread." Apple is famous for which of the following trace elements?

(a) Calcium
(b) Iron
(c) Sodium
(d) Potassium

67. The date is one of the most nourishing fruits. It is a food of great importance and is called the bread of the Sahara. It is a rich source of:

(a) Carbohydrates
(b) Proteins
(c) Fat
(d) Water

68. The lemon is an important fruit of citrus group. It ranks high as a health food ingredients. Lemon is rich in which organic acid?

(a) Tartaric acid
(b) Lactic acid
(c) Citric acid
(d) Oxalic acid.

69. The mango enjoys a unique status among the fruits. It is the most popular fruit of the tropics and is called "The king of Asiatic fruits." It is regarded as a valuable item of diet and a household remedy. About how many varieties of mangoes are cultivated in Pakistan?

(a) 10
(b) 20
(c) 35
(d) 30

70. The orange is one of the finest gifts of nature, It is the most popular wide-spread of the citrus fruits. It is very delicious and nourishing fruit. The orange is a native of which country?

(a) India
(b) Pakistan
(c) China
(d) Brazil

71. Vegetables are important protective food and highly beneficial for the maintenance of health and prevention of disease. They contain valuable food ingredients which can be successfully utilized to build up and repair the body. The carrot is a popular vegetable the world over. What important vitamin is linked with this vegetable?

(a) A (b) D
(c) C (d) K.

72. The garlic, a garden vegetable of the onion family, has been cultivated from time immemorial. It has been variously described as a food, a herb, a medicinal plant, an antiseptic, a beauty accessory and a magical antidote to evil by various people at different times throughout the age. Garlic is a native of which country?

(a) England (b) China
(c) Pakistan (d) Brazil

73. The onion, a pungent edible of the lily family, is one of the oldest cultivated vegetables. It is considered a food of exceptional value for flavouring and seasoning. What is responsible for the irritating colour in onions?

(a) Organic halogen compounds.
(b) Organic sulphur compounds
(c) Organic phosphorous compounds.
(d) Organic hydrogen compounds.

74. Which one of the following is a air-born disease?

(a) Whooping cough (b) Malaria
(c) Filana (d) Rabies.

75. Which one of the following is a water-born disease?

(a) Cholera (b) Yellow fever
(c) Plague (d) Measles.

76. Which one of the following is a blood - born disease?

(a) Malaria (b) TB
(c) Hepatitis (d) Filaria

77. Which one of the following is Gram negative bacteria?

(a) Streprcrcus (b) Gonococcas
(c) Anthrax bacillus (d) Tetanus bacillus.

78. Which one of the following diseases is not caused by bacteria?

(a) Pertussis (b) Aids
(c) Cholera (d) Malaria.

79. Which one of the following antibiotic is not Bactereostatic?

(a) Tetracycle (b) Erythromycine
(c) Linomycin (d) Kenamycin

80. Which one of the following antibiotics is not Bactericidal?

(a) Cefoxitin (b) Cefamandole
(c) Chloramphenicol (d) Cefobid.

81. Which one of the following is not a viral disease?

(a) Measles (b) Malaria
(c) Mumps (d) Hepatitis.

82. Which one of the following pesticides are used to kill rats and mice.

(a) Insecticides (b) Rodenticides

(c) Herbicides (d) Fungicides.

83. Which one of the following is not a chlorinated pesticide?

(a) DDT (b) Aldrin

(c) Captan (d) TEPP.

84. The average calorie requirement of a normal adult person ranges between 2500-4000 K. cal depending upon the nature of his work. For which of the following conditions, it is the lowest?

(a) Sedentary (b) Light work

(c) Heavy work (d) Moderate work.

85. Which one of the following processes operate in Basal Metabolism?

(a) Respiration and blood circulation.

(b) Digestion

(c) Excretion and Maintenance

(d) All the above.

86. Which of the following nutrients of food contain nitrogen?

(a) Carbohydrates (b) Oils

(c) Fats (d) Proteins

87. What is the daily requirements of vitamin A?

(a) 5000IU (b) 4000IU

(c) 3000IU (d) 20001U.

88. What is the daily requirement of vitamin C.

(a) 90 mg (b) 60 mg

(c) 40 mg (d) 20 mg.

89. What is the other name for vitamin C?

(a) Ascorbic acid (b) Citric acid

(c) Tartaric acid (d) Lactic acid.

90. Iron is essential for your blood circulation. What "eats" contain it?

(a) Liver (b) Egg

(c) Green vegetables (d) All the above.

91. Sandwich Buns are a good source of:

(a) Sodium (b) Calcium

(c) Potassium (D) Magnesium

92. When we do work we use the heat of the body — the utilization of body calories. Different activities require different amount of calories. In which of the following activities, there is maximum calorie loss?

(a) Dancing (b) Swimming

(c) Bicycling (d) Jogging.

93. About how many calories are lost per minute by an average weight adult during jogging?

(a) 10 calories (b) 20 calories

(c) 30 calories (d) 40 calories.

94. Which one of the following activities is less calorie demanding?

(a) Swimming (b) Walking

(c) Hiking (d) Gardening.

95. Fiber is very essential for a balanced diet. Food may be water soluble or water insoluble which one of the following is not an example of water-soluble fiber source.

(a) Oat-bran (b) Wheat germ

(c) Straberries (d) Apples.

96. Which one of the following is not an example of water insoluble fiber source?

(a) Carrots (b) Broccoli

(c) Asparagus (d) Bananas.

97. Which one of the following foods is the most high calorific?

(a) Dried apricots (b) Almonds

(c) Cabbage (d) Ice Cream.

98. Some starches are gentler on blood sugar than others. Often, the less processing, the slower blood sugar rises which one of the following food items has high glycemic index than white bread?

(a) Grapefruit (b) Brown rice

(c) Baked potato (d) Oatmeal

99. More physicians are now recommending diets that contain food rich in Omega-3-polyunsaturates. Which one of the following foods has it?

(a) Potato (b) Beef

(c) Fish (d) Carrots.

100. The Grapefruit occupies a high place among the citrus fruits because of its flavour, its appetising properties and its refreshing qualities. It is high in:

(a) Potassium and vitamin C.

(b) Sodium and vitamin A:

(c) Potassium and vitamin D.

(d) Sodium and vitamin C.

KEY TO MCQs

1. (c)	2. (d)	3. (d)	4. (d)	5. (a)	6. (b)	7. (d)
8. (c)	9. (d)	10. (a)	11. (a)	12. (d)	13. (c)	14. (c)
15. (b)	16. (c)	17. (a)	18. (c)	19. (b)	20. (a)	21. (b)
22. (c)	23. (b)	24. (b)	25. (b)	26. (d)	27. (c)	28. (b)
29. (a)	30. (d)	31. (d)	32. (b)	33. (a)	34. (b)	35. (d)
36. (c)	37. (b)	38. (b)	39. (c)	40. (c)	41. (d)	42. (b)
43. (c)	44. (c)	45. (d)	46. (c)	47. (d)	48. (c)	49. (d)
50. (c)	51. (d)	52. (d)	53. (a)	54. (c)	55. (b)	56. (c)
57. (a)	58. (b)	59. (c)	60. (a)	61. (d)	62. (d)	63. (d)
64. (b)	65. (d)	66. (b)	67. (a)	68. (c)	69. (c)	70. (c)
71. (a)	72. (b)	73. (b)	74. (a)	75. (a)	76. (c)	77. (b)
78. (b)	79. (d)	80. (c)	81. (b)	82. (b)	83. (d)	84. (a)
85. (d)	86. (d)	87. (a)	88. (b)	89. (b)	90. (d)	91. (b)
92. (d)	93. (a)	94. (b)	95. (b)	96. (d)	97. (a)	98. (c)
99. (c)	100. (a)					

CHAPTER 5

INFORMATION TECHNOLOGY

TELECOMMUNICATIONS

Basics of Wireless Communications

There are a variety of wireless communication systems for transmitting voice, video, and data in local or wide areas. There are point-to-point wireless bridges, wireless local area networks, multidirectional wireless cellular systems, and satellite communication systems.

This topic discusses "mobile" wireless technologies that provide voice and data communication services to mobile users who use cell phones, PDAs, internet terminals, and related computing devices.

The number of wireless mobile devices is increasing globally. Users equipped with portable computers, PDAs (personal digital assistants), and a variety of small wireless communication devices increasingly need to connect to corporate networks, perform database queries, exchange messages, transfer files, and even participate in collaborative computing. At the same time, wireless systems are achieving higher data rates to support Internet and other data-related applications. The newest mobile communication systems are targeting data rates as high as 2 Mbits/sec.

Cellular Systems and Topology

A cell in a cellular system is a roughly circular area with a central transmitter/ receiver base station as shown in Figure W-6 (although the base station may be located off-center to conform to local topology). The station is raised up on a tower or placed on top of a building. Some are located on church steeples. The station has a 360-degree omni-directional antenna (except when directional transmissions are required) that is tuned to create a cellular area of a specific size. Cells are usually pictured as hexagonal in shape and arranged in a honeycomb pattern. Cell size varies depending on the area. In a city, there are many smal cells, while rural area may have very large cells.

When a user turns a phone on, its phone number and serial number are broadcas within the local ceil. The base station picks up these signals and informs the switching offic that the particular device is located within its area. This information is recorded by th switching office for future reference. An actual call takes place when the user enters a phon number and hits the Send button. The cellular system selects a channel for the user to us during the duration of the call.

Cellular systems are described in multiple generations, with third and fourt generation (3G and 4G) systems just emerging:

GSM (Global System for Mobile Communications): This is a second-generation mobile system designed from the ground up without trying to be backward compatible with older analog systems. GSM is popular in Europe and Asia, where it provides superior roaming ability among countries. It uses TDMA, but Europe is moving from this system into 3G systems based on a wideband form of CDMA.

Information system development

Information technology departments in larger organizations tend to strongly influence the development, use, and application of information technology in the organizations. A series of methodologies and processes can be used to develop and use an information system. Many developers now use an engineering approach such as the system development life cycle (SDLC), which is a systematic procedure of developing an information system through stages that occur in sequence. Recent research aims at 'enabling and measuring' the ongoing, collective development of such systems within an organization by the entirety of human actors themselves. An information system can be developed in house (within the organization) or outsourced. This can be accomplished by outsourcing certain components or the entire system. A specific case is the geographical distribution of the development team (offshoring, global information system). A computer based information system, following a definition of Langefors, is a technologically implemented medium for

- recording, storing, and disseminating linguistic expressions,
- as well as for drawing conclusions from such expressions.

Geographic information systems, land information systems, and disaster information systems are examples of emerging information systems, but they can be broadly considered as spatial information systems. System development is done in stages which include:

- Problem recognition and specification
- Information gathering
- Requirements specification for the new system
- System design
- System construction
- System implementation
- Review and maintenance.

The "classic" view of information systems found in the textbooks in the 1980s was of a pyramid of systems that reflected the hierarchy of the organization, usually transaction processing systems at the bottom of the pyramid, followed by management information systems, decision support systems, and ending with executive information systems at the top. Although the pyramid model remains useful, since it was first formulated a number of new technologies have been developed and new categories of information systems have emerged, some of which no longer fit easily into the original pyramid model. Some examples of such systems are:

- data warehouses
- enterprise resource planning
- enterprise systems
- expert systems

- search engines
- geographic information system
- global information system
- office automation.

A **computer(-based) information system** is essentially an IS using computer technology to carry out some or all of its planned tasks. The basic components of computer based information system are:

- *Hardware*—these are the devices like the monitor, processor, printer and keyboard, all of which work together to accept, process, show data and information.
- *Software*—are the programs that allow the hardware to process the data.
- *Databases*—are the gathering of associated files or tables containing related data.
- *Networks*—are a connecting system that allows diverse computers to distribute resources.
- *Procedures*—are the commands for combining the components above to process information and produce the preferred output.

The first four components (hardware, software, database, and network) make up what is known as the information technology platform. Information technology workers could then use these components to create information systems that watch over safety measures, risk and the management of data. These actions are known as information technology services.

Wireless Networks

Wireless networking is used to meet many needs. Perhaps the most common use is to connect laptop users who travel from location to location. Another common use is for mobile networks that connect via satellite. A wireless transmission method is a logical choice to network a LAN segment that must frequently change locations. The following situations justify the use of wireless technology:

- To span a distance beyond the capabilities of typical cabling.
- To provide a backup communications link in case of normal network failure.
- To link portable or temporary workstations,
- To overcome situations where normal cabling is difficult or financially impractical, or
- To remotely connect mobile users or networks.

Developers need to consider some parameters involving Wireless RF technology for better developing wireless networks:

- Sub-GHz versus 2.4 GHz frequency trends
- Operating range and battery life
- Sensitivity and data rate
- Network topology and node intelligence

Applications may involve point-to-point communication, point-to-multipoint communication, broadcasting, cellular networks and other wireless networks. Wi-Fi technology.

Cordless—The term "wireless" should not be confused with the term "cordless", which is generally used to refer to powered electrical or electronic devices that are able to operate from a portable power source (e.g., a battery pack) without any cable or cord to limit the mobility of the *cordless* device through a connection to the mains power supply.

Some cordless devices, such as *cordless telephones*, are also wireless in the sense that information is transferred from the cordless telephone to the telephone's base unit via some type of wireless *communications link*. This has caused some disparity in the usage of the term "cordless", for example in *Digital Enhanced Cordless Telecommunications*.

Light, colors, AM and FM radio, and electronic devices make use of the *electromagnetic spectrum*. The frequencies of the *radio spectrum* that are available for use for communication are treated as a public resource and are regulated by national organizations such as the *Federal Communications Commission* in the USA, or *Of com* in the United Kingdom. This determines which frequency ranges can be used for what purpose and by whom. In the absence of such control or alternative arrangements such as a privatized electromagnetic spectrum, chaos might result if, for example, airlines didn't have specific frequencies to work under and an *amateur radio* operator were interfering with the pilot's ability to land an *aircraft*. Wireless communication spans the spectrum from 9 kHz to 300 GHz.

APPLICATIONS OF WIRELESS TECHNOLOGY

Mobile telephones

One of the best-known examples of wireless technology is the *mobile phone*, also known as a cellular phone, with more than 4.6 billion mobile cellular subscriptions worldwide as of the end of 2010. These wireless phones use radio waves from signal-transmission towers to enable their users to make phone calls from many locations worldwide. They can be used within range of the *mobile telephone site* used to house the equipment required to transmit and receive the *radio signals* from these instruments.

Wireless data communications!

Wireless data communications are an essential component of mobile computing. The various available technologies differ in local availability, coverage range and performance, and in some circumstances, users must be able to employ multiple connection types and switch between them. To simplify the experience for the user connection manager software can be used, or a *mobile VPN* deployed to handle the multiple connections as a secure, single virtual network. Supporting technologies include:

Wi-Fi is a wireless *local area network* that enables portable computing devices to connect easily to the Internet. Standardized as *IEEE 802.11* a,b,g,n, *Wi-Fi* approaches speeds of some types of wired *Ethernet*. Wi-Fi has become the de facto standard for access in private homes, within offices, and at public hotspots. Some businesses charge customers a monthly fee for service, while others have begun offering it for free in an effort to increase the sales of their goods. Cellular data service offers coverage within a range of 10-15 miles from the nearest cell. Speeds have increased as technologies have evolved, from earlier technologies such as *GSM*. *CDMA* and *GPRS*. to 3G networks such as *W-CDMA*. *EDGE* or CDMA2000.

Mobile Satellite Communications may be used where other wireless connections are unavailable, such as in largely rural areas or remote locations. Satellite communications are especially important for *transportation*, *aviation*, *maritime* and *military* use. Wireless Sensor Networks are responsible for sensing noise, interference, and activity in data collection networks. This allows us to detect relevant quantities, monitor and collect data, formulate meaningful user displays, and to perform decision-making functions.

Wireless energy transferred

Wireless energy transfer is a process whereby electrical energy is transmitted from a power source to an electrical load that does not have a built-in power source, without the use of interconnecting wires. There are two different fundamental methods for wireless energy transfer. They can be transferred using either far-field methods that involve beam power/lasers, radio or microwave transmissions or near-field using induction. Both methods utilize electromagnetism and magnetic fields.

Wireless Medical Technologies

New technologies such as mobile body area networks (MBAN) the capability to monitor blood pressure, heart rate, oxygen level and body temperature, all with wireless technologies. The MBAN works by sending low powered wireless signals to receivers that feed into nursing stations or monitoring sites. This technology helps with the intentional and unintentional risk of infection or disconnection that arise from wired connections.

Communications satellite

A communications satellite is an artificial satellite that relays and amplifies through the use of a transponder, radio telecommunications signals, between a source and a receiver. Communications satellites are used for television, telephone, radio, internet, and military applications. There are over 2,000 communications satellites in Earth's orbit, used by both private and government organizations.

Wireless communication uses electromagnetic waves to carry signals. These waves require line-of-sight, and are thus obstructed by the curvature of the Earth. In order to communicate over great distances, satellites are used to redirect the signal.

There are two major classes of communications satellites, Passive and Active. Passive satellites only redirect (usually via reflection) the signal coming from the source, toward the direction of the receiver. With passive satellites, the reflected signal is not amplified before it returns to Earth, so it has the tendency to be very weak. This is because, as the electromagnetic wave moves through the atmosphere, particles within the atmosphere, air, water droplets and dust tend to attenuate the signal, thereby reducing its received level. This is known as Free-space path loss. Active satellites, on the other hand, amplify the received signal before re-transmitting it to the receiver on the ground.

Communications satellites orbit the Earth in one of three major ways. One of these orbits is called geosynchronous orbit (GEO), which is 19,300 nautical miles from Earth's surface. This orbit has the special characteristic in which satellites placed in this orbit can "stand still" with respect to a certain location on earth. That is, if a viewer on Earth were to look up into the sky and spot a satellite in GEO, it would seem as if it isn't moving. Closer to the Earth is the medium Earth orbit (MEO). it ranges from 500-1200 nautical miles above Earth. Below MEO is low Earth orbit (LEO) and is about 200 nautical miles above Earth.

As MEO and LEO are not able to keep satellites "stationary" like GEO, more satellites would be needed to obtain complete coverage over a certain area. However, due to their relatively small distance to the earth their signals are stronger.

The electromagnetic signals that communication satellites work with, have a large spectrum of wavelengths and frequencies. To keep these waves from interfering with one another, international organizations have certain rules and regulations describing which wavelength a certain company or group can use. By separating out wavelengths, communication satellites will have minimal interference and be able to communicate effectively.

Optical wireless communications (OWC) is a form of optical communication in which unguided visible, infrared (IR), or ultraviolet (UV) light is used to carry a signal.

OWC systems operating in the visible band (390-750 nm) are commonly referred to as visible light communication (VLC). VLC systems take advantage of light emitting diodes (LEDs) which can be pulsed at very high speeds without noticeable effect on the lighting output and human eye. VLC can be possibly used in a wide range of applications including wireless local area networks, wireless personal area networks and vehicular networks among others. On the other hand, terrestrial point-to-point OWC systems, also known as the free space optical (FSO) systems, operate at the near IR frequencies (750-1600 nm). These systems typically use laser transmitters and offer a cost-effective protocol-transparent link with high data rates, i.e., 10 Gbit/s per wavelength, and provide a potential solution for the backhaul bottleneck. There has also been a growing interest on ultraviolet communication (UVC) as a result of recent progress in solid state optical sources/detectors operating within solar-blind UV spectrum (200-280 nm). In this so-called deep UV band, solar radiation is negligible at the ground level and this makes possible the design of photon-counting detectors with wide field-of-view receivers that increase the received energy with little additional background noise. Such designs are particularly useful for outdoor non-line-of-sight configurations to support low power short-range UVC such as in wireless sensor and ad-hoc networks.

Based on the transmission range, OWC can be studied in five categories:

1. **Ultra-short range OWC:** chip-to-chip communications in stacked and closely packed multi-chip packages.
2. **Short range OWC:** wireless body area network (WBAN) and wireless personal area network (WPAN) applications under standard IEEE 802.15.7, underwater communications.
3. **Medium range OWC:** indoor IR and visible light communications (VLC) for wireless local area networks (WLANs) and inter-vehicular and vehicle-to-infrastructure communications.
4. **Long range OWC:** inter-building connections, also called Free-Space Optical Communications (FSO).

GLOBAL POSITIONING SYSTEM (GPS)

The Global Positioning System (GPS) is a space-based navigation system made up of a network of 24 satellites into orbit that provides location and time information in all weather conditions, anywhere on a near the earth. It was initially developed by the U.S. Department of Defense for military applications, but in 1980s the Government made the system available for civilian use. There is no subscription fees or setup charges to use GPS.

How it works?

GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS receivers take this information and use trilateration to calculate the user's exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. Now, with distance measurements from a few more satellites, the receiver can determine the user's position and display it on the unit's electronic map.

A GPS receiver must be locked on to the signal of at least 3 satellites to calculate a 2-D position (latitude and longitude) and track movement. With four or more satellites in view, the receiver can determine the user's 3-D position (latitude, longitude and altitude). Once the user's position has been determined, the GPS unit can calculate other information, such as speed, bearing, track, trip distance, distance to destination, sunrise and sunset time and more.

How accurate is GPS?

Today's GPS receivers are extremely accurate, thanks to their parallel multi-channel design. Our 12 parallel channel receivers are quick to lock onto satellites when first turned on, and they maintain strong locks, even in dense foliage or urban settings with tall buildings. Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers. Garmin GPS receivers are accurate to within 15 meters, on average.

The GPS satellite system

The 24 satellites that make up the GPS space segment are orbiting the earth about 12,000 miles above us. They are constantly moving, making two complete orbits in less than 24 hours. These satellites are travelling at speeds of roughly 7,000 miles an hour.

GPS satellites are powered by solar energy. They have backup batteries on board to keep them running in the event of a solar eclipse, when there's no solar power. Small rocket boosters on each satellite keep them flying in the correct path.

Here are some other interesting facts about the GPS satellites (also called NAVSTAR, the official U.S. Department of Defense name for GPS):

- The first GPS satellite was launched in 1978.
- A full constellation of 24 satellites was achieved in 1994.
- Each satellite is built to last about 10 years. Replacements are constantly being built and launched into orbit.
- A GPS satellite weighs approximately 2,000 pounds and is about 17 feet across with the solar panels extended.
- Transmitter power is only 50 Watts or less.

What's the signal?

GPS satellites transmit two low power radio signals, designated LI and L2. Civilian GPS uses the LI frequency of 1575.42 MHz in the UHF band. The signals travel by line of sight, meaning they will pass through clouds, glass and plastic but will not go through most solid objects such as buildings and mountains.

A GPS signal contains 3 different bits of information – a pseudorandom code, ephemeris data and almanac data. The pseudorandom code is simply an I.D. code that identifies which satellite is transmitting information. You can view this number on your Garmin GPS unit's satellite page, as it identifies which satellites it's receiving. .

Ephemeris data, which is constantly transmitted by each satellite, contains important information about the status of the satellite (healthy or unhealthy), current date and time. This part of the signal is essential for determining a position.

The almanac data tells the GPS receiver where each GPS satellite should be at any time throughout the day. Each satellite transmits almanac data showing the orbital information for that satellite and for every other satellite in the system.

Calculating a Position

A GPS receiver calculates its position by a technique called satellite ranging, which involves measuring the distance between the GPS receiver and the GPS satellites it is tracking. The range (the range a receiver calculates is actually a pseudorange, or an estimate of range rather than a true range) or distance, is measured as elapsed transit time. The position of each satellite is *known*, and the satellites transmit their positions as part of the "messages" they send via radio waves. The GPS receiver on the ground is the *unknown* point, and must compute its position based on the information it receives from the satellites.

Measuring Distance to Satellites

The first step in measuring the distance between the GPS receiver and a satellite requires measuring the *time* it takes for the signal to travel from the satellite to the receiver. Once the receiver knows how much time has elapsed, it multiplies the travel time of the signal times the *speed of light* (because the satellite signals travel at the speed of light, approximately 186,000 miles per second) to compute the distance. Distance measurements to four satellites are required to compute a 3-dimensional (latitude, longitude and altitude) position.

In order to measure the travel time of the satellite signal, the receiver has to know when the signal left the satellite *and* when the signal reached the receiver. Knowing when the signal reaches the receiver is easy, the GPS receiver just "checks" its internal clock when the signal arrives to see what time it is. But how does it "know" when the signal left the satellite? All GPS receivers are synchronized with the satellites so they generate the same digital code at the same time. When the GPS receiver receives a code from a satellite, it can look back in its memory bank and remember" when it emitted the same code. This little "trick" allows the GPS receiver to determine when the signal left the satellite.

SURVEILLANCE

Surveillance (/sar vei.ans/ or /sar'veilans/) is the monitoring of the behavior, activities, or other changing information, usually of people for the purpose of influencing, managing, directing, or protecting them. This can include observation from a distance by means of electronic equipment (such as CCTV cameras) or interception of electronically transmitted information (such as Internet traffic or phone calls); and it can include simple, relatively no- or low-technology methods such as human intelligence agents and postal interception. The word *surveillance* comes from a French phrase for "watching over" ("sur" means "from above" and "veiller" means "to watch"), and is in contrast to more recent developments such as surveillance.

Computer

1. There is far too much data on the Internet for human investigators to manually search through all of it. So automated Internet surveillance computers sift through the vast amount of intercepted Internet traffic and identify and report to human investigators traffic considered interesting by using certain "trigger" words or phrases, visiting certain types of web sites, or communicating via email or chat with suspicious individuals or groups. Billions of dollars per year are spent, by agencies such as the Information Awareness Office, NSA, and the FBI, to develop, purchase, implement, and operate systems such as Carnivore, NarusInsight, and ECHELON to intercept and analyze all of this data, and extract only the information which is useful to law enforcement and intelligence agencies.

Telephones

2. The official and unofficial tapping of telephone lines is widespread. In the United States for instance, the Communications Assistance For Law Enforcement Act (CALEA) requires that all telephone and VoIP communications be available for real-time wiretapping by Federal law enforcement and intelligence agencies. Two major telecommunications companies in the U.S.—AT&T Inc. and Verizon—have contracts with the FBI, requiring them to keep their phone call records easily searchable and accessible for Federal agencies, in return for $1.8 million per year. Between 2003 and 2005, the FBI sent out more than 140,000 "National Security Letters" ordering phone companies to hand over information about their customers' calling and Internet histories. About half of these letters requested information on U.S. citizens.

Human agents are not required to monitor most calls. Speech-to-text software creates machine-readable text from intercepted audio, which is then processed by automated call-analysis programs, such as those developed by agencies such as the Information Awareness Office, or companies such as Verint, and Narus, which search for certain words or phrases, to decide whether to dedicate a human agent to the call.

3. Cameras

Surveillance cameras are video cameras used for the purpose of observing an area. They are often connected to a recording device or IP network, and may be watched by a security guard or law enforcement officer. Cameras and recording equipment used to be relatively expensive and required human personnel to monitor camera footage, but analysis of footage has been made easier by automated software that organizes digital video footage into a searchable database, and by video analysis software (such as VIRAT and HumanID). The amount of footage is also drastically reduced by motion sensors which only record when motion is detected. With cheaper production techniques, surveillance cameras are simple and inexpensive enough to be used in home security systems, and for everyday surveillance

4. Social network analysis

One common form of surveillance is to create maps of social networks based on data from social networking sites such as Facebook.MvSpace. Twitter as well as from traffic analysis information from phone call records such as those in the NSA call database and others. These social network "maps" are then data mined to extract useful information such as personal interests, friendships & affiliations, wants, beliefs, thoughts, and activities.

5. Biometric

Biometric surveillance is any technology that measures and analyzes human physical and/or behavioral characteristics for authentication, identification, or screening purposes. Examples of physical characteristics include fingerprints, DMA, and facial patterns. Examples of mostly behavioral characteristics include gait (a person's manner of walking) or voice.

6. Aerial

Aerial surveillance is the gathering of surveillance, usually visual imagery or video, from an airborne vehicle—such as an unmanned aerial vehicle, helicopter, or spy plane. Military surveillance aircraft use a range of sensors (e.g. radar) to monitor the battlefield.

Digital imaging technology, miniaturized computers, and numerous other technological advances over the past decade have contributed to rapid advances in aerial surveillance hardware such as micro-aerial vehicles, forward-looking infrared, and high-resolution imagery capable of identifying objects at extremely long distances.

7. Data mining and profiling

Data mining is the application of statistical techniques and programmatic algorithms to discover previously unnoticed relationships within the data. Data profiling in this context is the process of assembling information about a particular individual or group in order to generate a profile — that is, a picture of their patterns and behavior. Data profiling can be an extremely powerful tool for psychological and social network analysis. A skilled analyst can discover facts about a person that they might not even be consciously aware of themselves.

8. Corporate

Corporate surveillance is the monitoring of a person or group's behavior by a corporation. The data collected is most often used for marketing purposes or sold to other corporations, but is also regularly shared with government agencies.

Application of business software

Business software or business application is any software or set of computer programs that are used by business users to perform various business functions. These business applications are used to increase productivity, to measure productivity and to perform business functions accurately.

By and large, business software is likely to be developed specifically for a business and therefore is not easily transferable to a different commercial enterprise, unless its nature and operation is identical. This is due to the unique requirements of each business that off-the-shelf software in unlikely to completely address. However, where an on-the-shelf solution is necessary, due to time or monetary considerations, some level of customization is likely to be required. Exceptions do exist, depending on the business in question, and thorough research is always required before committing to bespoke or off-the-shelf. Some business applications are interactive, i.e., they have a graphical user interface or user interface and users can query/modify/input data and view results instantaneously. They can also run reports instantaneously. Some business applications run in batch mode i.e. they are set up to run based on a predetermined event/time and business user does not need to initiate them or monitor them.

The term covers a large variation of users within the business environment, and can be categorized by using a small, medium and large matrix:

- The small business market generally consists of home accounting software, and office suites such as OpenOffice.org or Microsoft Office.
- The medium size, or small and medium-sized enterprise (SME), has a broader range of software applications, ranging from accounting, groupware, customer relationship management, human resource management systems, outsourcing relationship management, loan origination software, shopping cart software, field service software, and other productivity enhancing applications.
- The last segment covers enterprise level software applications, such as those in the fields of enterprise resource planning, enterprise content management (ECM), business process management (BPM) and product lifecycle management. These applications are extensive in scope, and often come with modules that either add native functions, or incorporate the functionality of third-party computer programs.

Application support

Business applications are built based on the requirements from the business users. Also, these business applications are built to use certain kind of Business transactions or data items. These business applications run flawlessly until there are no new business requirements or there is no change in underlying Business transactions. Also, the business applications run flawlessly if there are no issues with computer hardware, computer network (Intenet/intranet), computer disks, power supply, and various software components (middleware, database, computer programs, etc.).

Business applications can break when an unexpected error occurs. This error could occur due to data error (unexpected data input or wrong data input), environment error (infrastructure related errors), programming error, human error and work flow error. When business application breaks one needs to fix the business application error as soon as possible so that Business user can resume their work. This work of resolving business application error is known as business application support.

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COMPUTERS

Definition:

Computer, as a term typically refers to an automatic device capable of solving a problem by executing a prescribed programme of series of instructions. Electronic computers were first used in 1940s in a few research laboratories and by the late 1960s had become common place tools in data processing for government, business and industry. Electronic computer can accept data, apply a series of logical processes to it, and supply the results of these processes of information. The computer is probably the most, versatile invention of all times.

Purpose of Computers:

Computers are used to perform complex series of mathematical calculations at very great speed. This makes them of great use for a variety of purposes, such as routine office calculations, control of industrial processes, and the control of spacecraft flight paths. Their ability to perform these operations depends not only on their mathematical capabilities, but also on their ability to store information and retrieve specified bits of information in the appropriate circumstances.

Classes of Computers:

The two main types of computers are:

(i) The Analogue and

(ii) The Digital.

The basic difference between them is that digital computer counts, and analogue computer compares.

THE ANALOGUE COMPUTER	THE DIGITAL COMPUTER
An analogue computer is device in which physical quantities like electrical potential, fluid pressure, mechanical motion etc. are represented in a way analogous to the relation of the corresponding quantities to be solved. A widely used analogue computer is the slide rule.	In the digital computer, physical quantities take on discrete value; usually numbers in the binary notation. These quantities change with time by the occurrence of simple arithmetic operations (addition, subtraction, multiplication or division) or logical operations on the representation of the numbers. Digital computers operate through combination of open and closed circuits.

Basic Parts of a Computer:

The basic components of all computers are the same and they are discussed below:

(A) **Input Device:** Data enters through it. It is actually the keyboard.

(B) **Central Processing Unit (CPU):** Once the data is entered, it is transferred to the central processing unit. This unit is like the brain of a computer and it consists of three parts:

(i) ***The Control Unit:*** It controls all the functions performed by the various parts of computer.

(ii) ***The Memory Unit:*** It stores vital information such as computer language codes. Memory of a computer is divided into two parts: Random Access Memory (RAM) and Read Only Memory, (ROM).

(iii) ***Arithmetic Logic Unit:*** It does all the required calculations.

Binary Notation:

Digital computers store data in binary notation, which reduces all numbers, text and formulae to a series of O_s and I_s. Thus each element in a complete memory need only represent either the digit 0 or digit 1.

Computer Language:

Computer programmes are written in special languages. Automation of symbolic coding process gives rise to procedure oriented languages like FORTAN, ALGOL, COBOL etc. and Problem Oriented languages like GPSS and APT. All these languages are designed as to be automatically read into the computer.

COMPUTER VIRUS

It is a small but deadly programme like a parasite that lurks in the darkest recesses of a computer waiting for an opportunity to spring to life. It is basically an electronic information disorder. A computer virus carries in its instructional code, the recipe for making perfect copies of itself; a self-replicating programme, which, when logged into a host computer, takes temporary control of the computer's disk operating system. Then, whenever the infected computer comes in contact with an uninfected piece of software, a fresh copy of the virus passes into the new programme. Thus the infection can be spread from computer to computer by unsuspecting users who either swap disk or send programmes to one another over telephone lines. Once a computer has been infected by a virus, the invader can sometimes be eradicated by a special programme that searches out and erases each bit of foreign material. The computer has to be shut down and its memories purged.

It is relatively a new phenomenon and has been around for the last two decades. The discovery of computer virus has been named as artificial intelligence.

Kinds of Computer Viruses:

The following four kinds of computer viruses have been identified:

1.	Boot Infectors
2.	System Infectors
3.	Programme Infectors
4.	Data Infectors

These kinds include about 350 viruses in total. The one invented by two Pakistani brothers was called the **"Brain Virus".** The basic purpose of this creation was protection against piracy.

Precautions for Protection:

The following points should be strictly followed to decrease the chances of infection of the computers by viruses;

1. Do not use pirated programmes.

2. Do not share disks.
3: Do not copy software.
4. Do not let anyone touch your machine.

Laptop:

A laptop is personal computers designed for mobile use and small and light enough to sit in a person's lap while in use. They have many advantages like portability, low power consumption, better built-in-camera, less weight and more accessories. These things make laptop more popular than desktop computers.

TERMS USED IN COMPUTERS

Hardware and Software:

The components of the computer system can be broken into two categories: namely hardware and software. Hardware is that plastic made part of the computer which houses electronic materials. It also includes knobs and other containers. Software is that delicate part of computer which contains electronic circuits, chips and transistors.

Peripherals:

Peripherals are other devices which are connected to the computer the keyboard, video display, screen, printers and other different types of data storage devices.

Microcomputers:

These are business and research oriented computes that cost much less than mainframes but can perform many of the same tasks, though not always on the same scale. The basic building blocks of a microcomputer are located on a single chip of silicon, the size of your fingertip. These computers consist of thousands of microscopic transistors and circuits that are attached on the silicon wafer. Technically, a microcomputer consists of a microprocessor, a memory and a display circuit.

Microprocessor:

Microprocessor is the brain of a microcomputer; it performs the calculations received and returns the results in proper order. The microprocessor has a control unit, that synchronizes the sequences of operations performed on the incoming data, and arithmetic-logic unit that adds, subtracts, and recognises the data.

Transistor:

A transistor is a sandwich of semi-conductor materials with the same impurity in the two outer layers and a different impurity in the central layer providing current carriers of opposite charges to those produced by the outer layers.

GLOSSARY OF COMPUTERS

Access time. It is the time required for a computer to locate and transfer data to or from a storage device.

Accumulator. A local storage area, known as a register in the central processor. It temporarily holds the results of computer processing operations.

Analog Computer. Analog computers are designed to perform arithmetical functions upon numbers which are represented by some physical quantity e.g., in electrical analog machines voltages are used to represent the input variable.

Arithmetic and Logical Unit (ALU). It is that part of the central processor which organizes controls and carries out arithmetic and logical processes.

Architecture. Relates to the way in which software and hardware are designed and constructed to achieve the objectives like ease of maintenance, ability to control several applications at once, cost and speed etc.

Artificial intelligence. This refers to the use of computers in such a way that they person various operations and at the same time take decisions as the human beings do.

Assembler. The program which converts source language statements of low level languages into equivalent machine language.

Auxiliary storage (Backing Storage). Storage located outside the central processor but connected to it. It can be a magnetic disk, a magnetic drum etc.

BASIC. A high level programming language. It is an easy to learn tool for the beginners. The mode of the language is conversational. The acronym stands for Beginner's All-purpose Symbolic Instruction Code.

Batch processing. A technique to process data. Data to be processed are collected into a group, called a batch, prior to processing.

Binary. The number system using base 2. It has only two digits 0 (zero) and 1 (one).

Binary Coded Decimal Interchange Code (BCDIC). A six bit internal code that has 64 character choices, also called BCD.

Bit. It is abbreviation of binary digit. A single binary digit 0 or 1 is known as a bit.

Bus. A group of circuits that provide the communication path between the various elements of a digital computer.

BYTE. A fixed number of adjacent bits that represent a meaningful written language symbol. Most common byte size is eight bits.

Capacity. Number of characters that can be stored in a computer memory. If the storage capacity is 16 K bytes then it is 16 × 1024 bytes.

Card reader. Input device for sensing the holes in the punched cards.

Card punch. Output device that converts data from a binary format in main storage to coded whole patterns is a punched card.

Central Processing Unit (CPU). Nerve centre of the digital computer system and it coordinates and controls the activities of all the other units. It consists of three hardware sections: main memory, arithmetic unit and a control section.

Chain printer. A printer that uses a rotating print chain.

Channel. A horizontal strip running the full length of the magnetic tape and is used for recording data.

Character. Any of the written language symbols letters A-Z; numbers 0-9 and special symbols.

Character printer. A printer which prints one character at a time.

Chip. An extremely small piece of silicon on which integrated circuits are fabricated.

Compiler. A translator program used for problem oriented languages. It translates source program instructions to actual machine language instructions. COBOL, FORTRAN, PL/1 i.e. all the high level languages, use compilers.

Computers. It is a machine which accepts data in a prescribed form, processes it and gives the output in a specified form.

Curson. The flashing light on the computer screen which specifies the current printing position.

Data. A collection of unorganized facts.

Data processing. The preparation of source data, classifying, sorting, calculating and outputting the data into meaningful form.

Debugging. A technique of detecting and correcting errors.

Debug-on-line. To detect and correct errors in a program from a remote console in a multi-access system.

Direct Access Storage (DAS). These are the secondary storage devices like disk, drum etc. These can be used to read/write a record directly without reading or rewriting the entire file.

EBCDIC. Acronym for Extended Binary Coded Decimal Interchange Code. It is a 8 bit code that uses zones and digit areas to represent characters.

EDGE. This pertains to the 9 to 12 edge of the punched card.

Electro-thermal printer. A high speed printer.

Face. That side of the punched card which bears the punching.

Feed. To cause the data to be entered into a computer through the input device for processing.

Field. A group of characters that collectively represents a record—a student roll number, name, weight etc. are fields.

File. A collection of related records in an organised fashion.

Flip-flop. A circuit that is always in one of the two states 0 or 1 and nature of the state is reversed on receipt of the input signal.

Format. The predetermined arrangement of data.

FORTRAN. Acronym for FORmula TRANslation. It is a high level language for scientific and mathematical use.

Hard copy. A print out from the printer, soft copy is the one that is stored in the computer memory.

Hardware. Refers to the physical equipment and devices that make up the computer; like central processor, storage devices and peripheral devices.

High level languages. Refers to those programming languages in which on source instruction is translated to several object instruction for example COBOL, FORTRAN RPG and pL/1 etc.

Hollerith card. A punched card in which information is punched using Hollerith code.

Hollerith code. This is the coding system used for punched cards.

Hopper. A device which holds punch cards and presents them to a feed mechanism for reading or punching.

Information. Results of data processing.

Input. The process of conveying information to the computer through some input device.

Interpreter. A language processor for high level programming languages that translates the source code as the program is executed. It is the most common language processor for BASIC.

K. A symbol for expressing storage capacity. K is equal to 1024.

Key board. A device which encodes characters by the depression of keys.

Light pen. A highly sensitive photo electric device used for editing of data on CRT.

Line printer. A printer which prints out one line at a time. Chain printers and drum printers are the examples.

Machine language. Refers to instructions written in machine code and are executed directly by the central processor.

MAC mode. A method of using an operating system in which programs are submitted from remote terminals. It is acronym for Multi access computing.

Magnetic disk. It is a secondary storage device consisting of thin flat circular plates, coated with a magnetic material as a recording medium.

Memory. The area inside a computer frame (primary memory) and auxiliary storage where data and instructions are stored.

Multi processing. Pertains to computer system that uses more than one central processing unit.

Multiple processor. A central processor containing two or more independent arithmetic units and their associated control logic.

Nanosecond. One billionth (10^{-9}) of a second, it is a unit of time in computer.

Non-impact printers. High speed page printers. Picoseconds. One trillionth (10^{-12}) of a second.

Primary memory. Same as primary storage or main memory.

Printer. An output device that prints results stored in the main memory.

Programmer. The person who prepares a set of instructions, called a program.

Pseudocode. A code in which program instructions are written, making use of symbolic representation of operation codes.

Random access. Same as direct access.

RAM. Random Accessory Memory.

Read Only Memory (ROM). An area of memory that can only be read and not written on by a user.

Record. A collection of related data elements.

Secondary memory. Same as auxiliary memory, secondary storage or backing storage.

Software. Software is a term used in contrast to hardware. It refers to all programs which can be used on a particular computer system.

Teleprocessing. Transmission of data to a computer from a remote terminal.

Teletypewriter. A cheap input/output device that uses paper tape and is a part of a small computer system.

Terminal. A device often consisting of key board and a visual display unit which is connected to a computer. It can be used for remote entry and receiving information.

Time shared service. The use of a remote central computer and sharing it with other users.

Transaction. An event that generates a fact and it becomes an input to a data processing.

Unit record machine. An electro-mechanical machine which is used to process data punched into cards.

Video display. Same as CRT.

Word. Fixed size storage areas which store binary equivalents of decimal numbers. Instructions are also stored in words.

Word-processing. A system used in offices. It performs operations on words for storing, editing and manipulating text.

Xerographic printer. A high speed printer that uses Xerographic techniques to produce printed outputs.

ARTIFICIAL INTELLIGENCE

Introduction:

Artificial intelligence may be defined as the branch of computer science that is concerned with the automation of intelligent behavior. This definition is particularly appropriate because it emphasizes the conviction the conviction that artificial intelligence is a part of computer science so it should be based on sound theoretical and applied principles of this field. These principles include the data structure used in knowledge representation, the algorithms needed them to apply the knowledge, and the languages and programming techniques used in their implementation.

The simplest version of the artificial intelligence looks like a supposedly an intelligent computer programme which captures the vitality and complexity of the human mind. a real problem lies in the definition of the Intelligence itself, is intelligence a singles faculty, or is it just a name for a coactions of distinct and unrelated abilities?

There are certain unanswered questions:

(i) What happens when learning occurs?
(ii) What is creativity?
(iii) What is intuition?
(iv) Can intelligence be inferred from observable behavior, or does it require evidence of a particular internal mechanism?
(v) How is knowledge represented in the new tissue of a living being.
(vi) What is self-awareness, and what role does it play in intelligence.
(vii) The most crucial point of consideration is:

"Is it even possible to achieve intelligence on a computer, or does an intelligent ntity require the richness of sensation and experience that might be found only in a biological existence"?

Relationship of Artificial Intelligence with other fields:

1. The use of computers to do symbolic reasoning, pattern recognition, learning, or some other form of inference.
2. A focus on problems that do not respond to algorithmic solutions. This underlies the reliance on heuristic search as an AI problem-solving technique.
3. A concern with problem solving using inexact, missing, or poorly defined information and the use of representational formalisms that .enable the programmer to compensate for these problems.
4. Reasoning about the significant qualitative features of a situation.
5. An attempt to deal with issues of semantic meaning as well as syntactic form.
6. Answers that are neither exact nor optimal, but are in some sense "sufficient". This is a result of the essential reliance on heuristic problem-solving methods in situations where optimal or exact results are either too expensive or not possible.
7. The use of large amounts of domain-specific knowledge in solving problems. This is the basis of expert systems.
8. The use of meta-level knowledge to effect more sophisticated control of problem-solving strategies. Although this is a very difficult problem, addressed in relatively few current systems, it is emerging as an essential area of research.

We hope that this introduction provides some feel for the overall structure and significance of the field of artificial intelligence. We also hope that the brief discussions of such technical issues as search and representation were not excessively cryptic and obscure; they are developed in proper detail throughout the remainder of the text. They were included here to demonstrate their significance in the more general organization of the field.

As we mentioned in the discussion of agent-oriented problem solving, objects late on meaning through their relationships with other objects. This is equally true of the facts, theories; and techniques that constitute a field of scientific study. We have intended to give a sense of those interrelationships, so that when the separate technical themes of artificial intelligence are presented, they will find their place in a developing understanding of the overall substance and directions of the field. We are guided by an observation made by Gregory Bateson, the psychologist and systems theorist (Bateson 1979):

ARTIFICIAL INTELLIGENCE AS PRESENTATION AND SEARCH

All sciences characterize the essential nature of the systems they study. These characterizations are invariably qualitative in nature, for they set the terms with which more detailed knowledge can be developed.

The study of logic and computers has revealed to us that intelligence resides in physical symbol systems. This is computer science's most basic law of qualitative structure. Symbol systems are collections of patterns and processes, the tatter being capable of producing, destroying and modifying the former. The most important property of patterns is that they can designate objects, processes or other patterns, and that when they designate processes they can be interpreted.

A second law of qualitative structure for artificial intelligence is that symbol systems solve problems by generating potential solutions and testing them— that is by searching. Solutions are usually sought by creating symbolic expressions, and modifying them sequentially unfit they satisfy the conditions for solution.

Neweu And Simon, ACM Turing Award Lecture, 1976
(Newell and Simon 1976)

In their Turing Award Lecture, Newell and Simon argue that intelligent activity, in either human or machine, is achieved through the use of:

1. Symbol patterns to represent significant aspects of a problem domain.
2. Operations on these patterns to generate potential solutions to problems.
3. Search to select a solution from among these possibilities.

These assumptions form the basis for what is known as the *physical symbol system hypothesis*. This hypothesis justifies our efforts to build intelligent machines and makes explicit the underlying assumptions of artificial intelligence research.

The physical symbol system hypothesis implicitly distinguishes between the *patterns* formed by an arrangement of symbols and *the medium* used to implement them. If intelligence derives only from the structures of a symbol system, then any medium that successfully implements the correct patterns and processes will achieve intelligence, regardless of whether it is .composed of neurons, logic circuits, or Tinkertoys. The possibility of building a machine that will pass the Taring test depends on this distinction. According to the Church-Turing thesis (Machtey and Young 1979), computers are capable of implementing any effectively described symbolic process. It follows that a properly programmed digital computer will achieve intelligence.

The physical symbol system hypothesis also outlines the major foci of AI research and application development: defining the symbol structures and operations necessary for intelligent problem solving and developing strategies to efficiently and correctly search the potential solutions generated by these structures and operations. These are the interrelated issues of *knowledge representation and* research; together, they are at the heart of modern research in artificial intelligence.

The physical symbol system hypothesis is disputed by critics who argue that intelligence is inherently biological and existential, and cannot be captured symbolically. These arguments provide a well-considered challenge to the dominant direction of AI research, and have influenced the direction of research in neural networks, genetic algorithms and agent-based approaches.

Knowledge Representation

The function of any representation scheme is to capture the essential features of a problem domain and make that information accessible to a problem-solving procedure. It is obvious that a representation language must allow the programmer to express the knowledge needed for a problem solution. *Abstraction*, the representation of only that information needed for a given purpose is an essential tool for managing complexity. It is also important that the resulting programs be computationally efficient. *Expressiveness* and *efficiency* are major dimensions for evaluating knowledge representation languages. Many highly expressive representations, are too inefficient for use in certain classes of problems. Sometimes, expressiveness must be sacrificed to improve efficiency. This must be done without limiting this representation's ability to capture essential problem-solving knowledge. Optimizing the trade-off between efficiency and expressiveness is a major task for designers of intelligent systems.

Knowledge representation languages are also tools for helping humans to solve problems. As such, a representation should provide a *natural* framework for expressing, problem-solving knowledge; it should make that knowledge available to the computer and assist the programmer in its organization.

The visual scene is made up of a number of picture point, or pixel has both a location and a number value representing its gray level. It is natural, then, to collect the entire scene into a two-dimensional array where the row and column address gives the location of a pixel (X and Y coordinates) and the content of the array element is the gray level at that point. Algorithms are designed to perform operations like looking for isolated points to remove noise from the image, finding threshold levels for discerning objects and edges, summing contiguous elements to determine size or density, and in various other ways transforming the picture point data. Implementing these algorithms is straightforward, given the array representation and the FORTRAN language, for example. This task would be quite cumbersome using other representations such as the predicate calculus, records, or assembly code, because these do not have a natural fit with the material being represented.

When we represent the picture as an array of pixel points, we sacrifice fineness of resolution (compare a photo in a newspaper to the original print of the same picture). In addition pixel arrays cannot express the deeper semantic organization of the image. For example, a pixel array cannot represent the organization of chromosomes in a single cell nucleus, their genetic function, or the role of metaphase in cell division. This knowledge is more easily captured using a representation such as predicate calculus or semantic networks.

A representational scheme should:

1. Be adequate to express all of the necessary information.
2. Support efficient execution of the resulting code.
3. Provide a natural scheme for expressing the required knowledge.

McDermott and others have stated that the key to writing a successful knowledge-based program is the selection of appropriate representational tools. Often, lower-level language (BASIC, FORTRAN, C, etc:) programmers fail in building expert systems simply because these languages do not provide the representational power and modularity required for knowledge-based programming.

Two sides of artificial intelligence

Powerful computers will reshape humanity's future. How to ensure the promise outweighs the perils

The development of full artificial intelligence could spell the end of the human race, Stephen Hawking warns. Elon Musk fears that the development of artificial intelligence, or AI, may be the biggest existential threat humanity faces. Bill Gates urges people to beware of it.

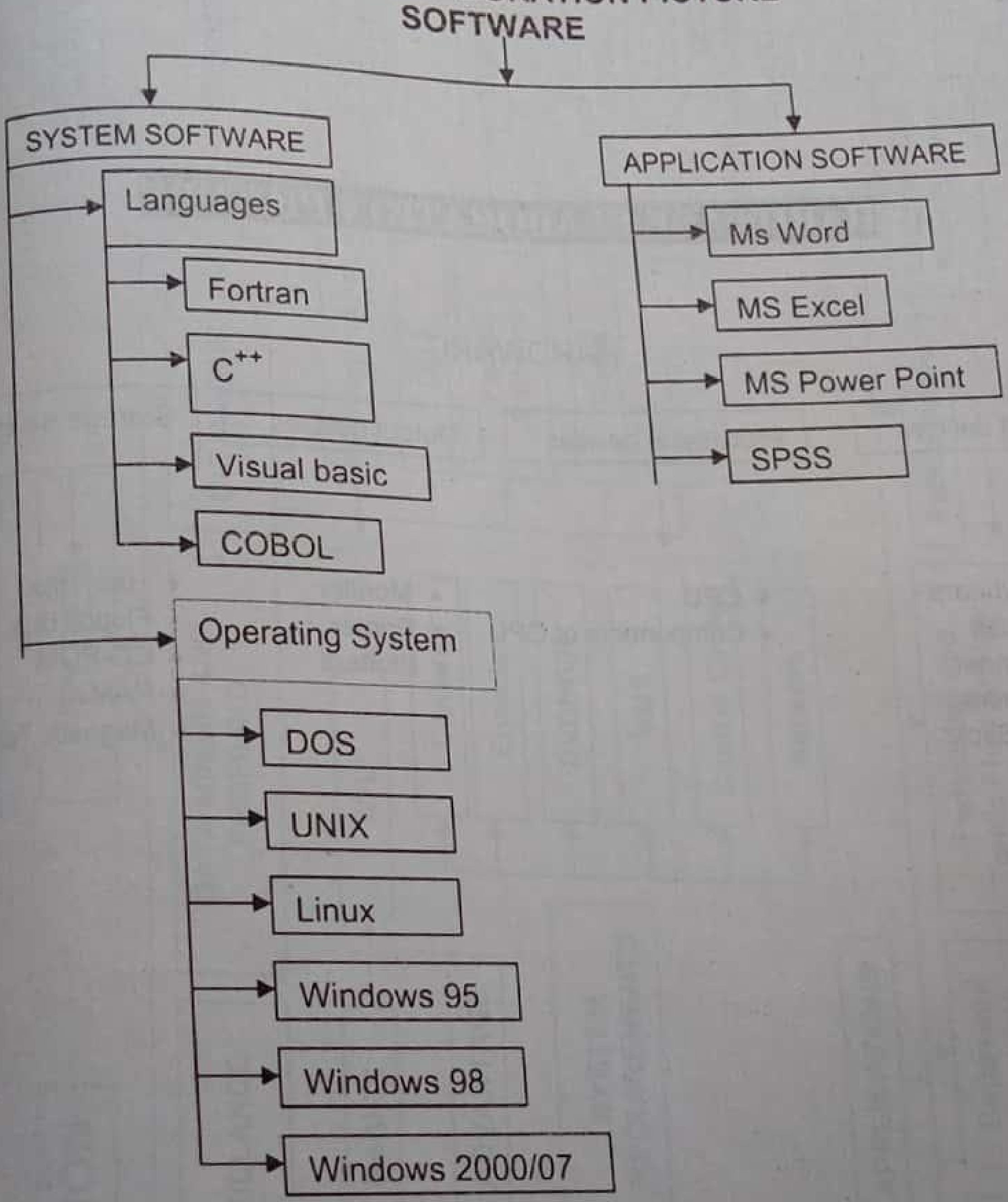
Dread that the abominations people create will become their masters, or their executioners, is hardly new. But voiced by a renowned cosmologist, a Silicon Valley entrepreneur and the founder of Microsoft—hardly Luddites—and set against the vast investment in AI by big firms like Google and Microsoft, such fears have taken on new weight. With supercomputers in every pocket and robots looking down on every battlefield, just dismissing them as science fiction seems like self-deception. The question is how to worry wisely.

Such artificially intelligent beings are still a very long way off; indeed, it may never be possible to create them. Despite a century of poking and prodding at the brain, psychologists, neurologists, sociologists and philosophers are still a long way from an understanding of how a mind might be made—or what one is. And the business case for even limited intelligence of the general sort—the sort that has interests and autonomy—is far from clear. A car that drives itself better than its owner sounds like a boon; a car with its own ideas about where to go, less so.

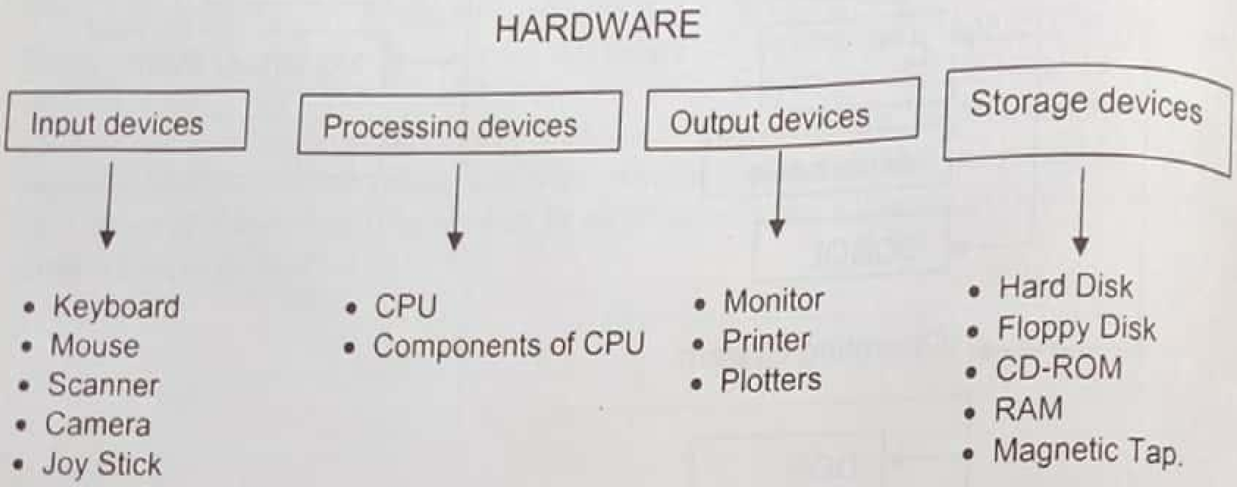
COMPUTER SOFTWARE

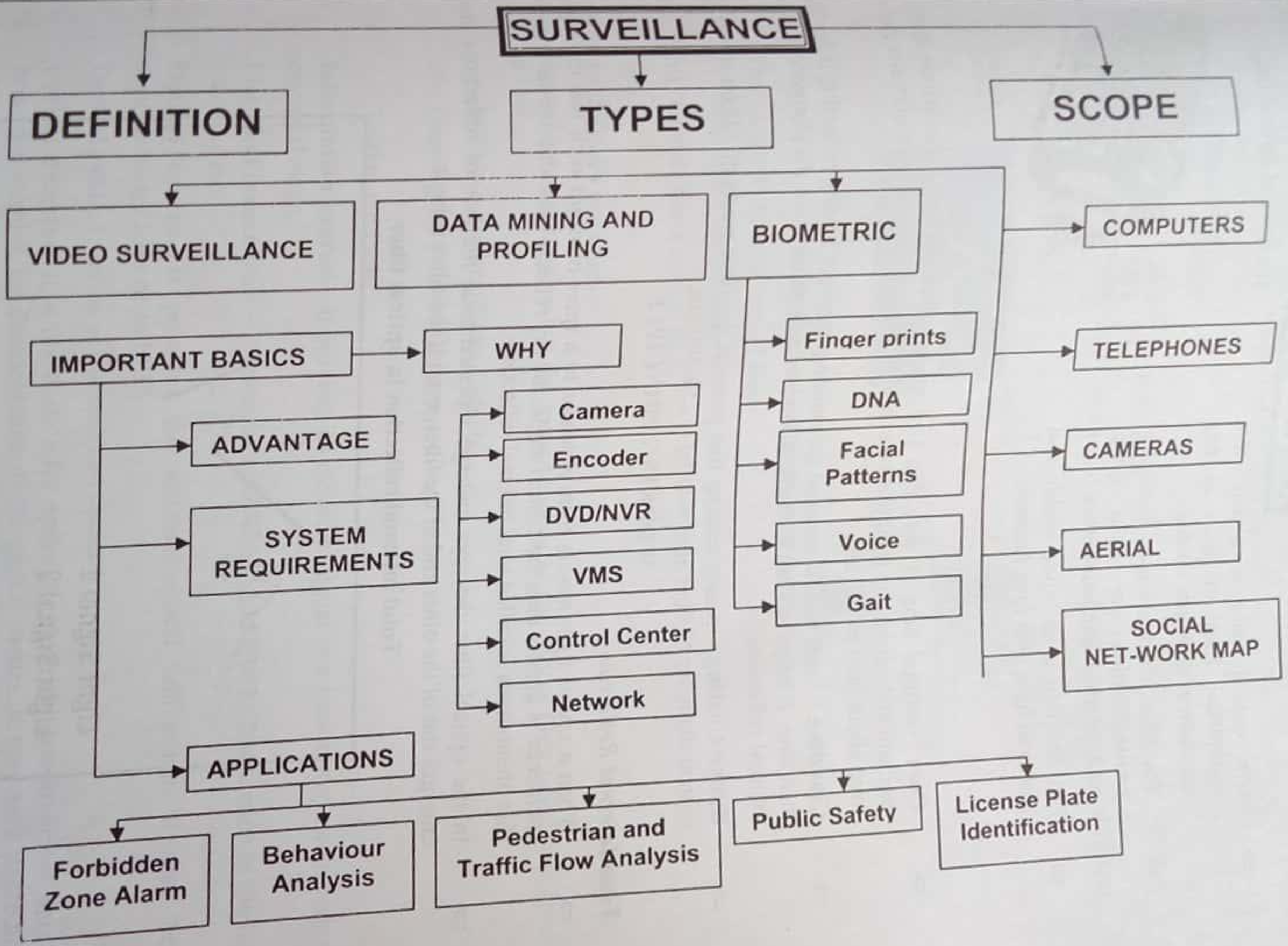
Computer Softwares are also known as programs, which can be defined as a set of instructions/codes written in a defined manner. In other words softwares are prewritten programs, which control the operation of computers.

SOFTWARE ELABORATION PICTURE



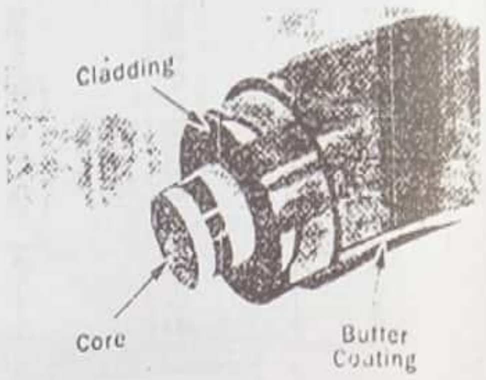
HARDWARE ELABORATION PICTURE




SURVEILLANCE
DEFINITION
TYPES
SCOPE
VIDEO SURVEILLANCE
DATA MINING AND PROFILING
BIOMETRIC
COMPUTERS
IMPORTANT BASICS
WHY
Finger prints
TELEPHONES
Camera
DNA
ADVANTAGE
Encoder
Facial Patterns
CAMERAS
SYSTEM REQUIREMENTS
DVD/NVR
Voice
AERIAL
VMS
Gait
Control Center
SOCIAL NET-WORK MAP
Network
APPLICATIONS
Forbidden Zone Alarm
Behaviour Analysis
Pedestrian and Traffic Flow Analysis
Public Safety
License Plate Identification

OPTIC FIBER

Structure of optical fiber



- ⇒ An optical fiber is a hair thin cylindrical fiber of glass or any transparent dielectric medium.
- ⇒ The fiber which are used for optical communication are wave guides made of transparent dielectrics.
- ⇒ Its function is to guide visible and infrared light over long distances.

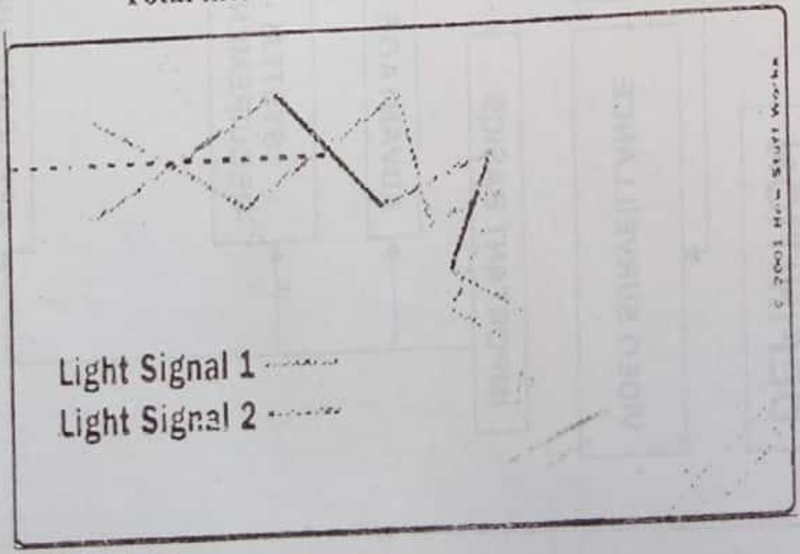
- ⇒ **Core** – central tube of very thin size made up of optically transparent dielectri medium and carries the light form transmitter to receiver. The core diameter can var from about 5um to 100 um.
- ⇒ **Cladding** – outer optical material surrounding the core having reflecting index lowe than core. It helps to keep the light within the core throughout the phenomena of tot internal reflection.
- ⇒ **Buffer Coating** – plastic coating that protects the fiber made of silicon rubber. Th typical diameter of fiber after coating is 250-300 um.

WORKING PRINCIPLE

Total Internal Reflection

- ⇒ When a ray of light travels from a denser to a rarer medium such that the angle incidence is greater than the critical angle, the ray reflects back into the same mediu this phenomena is called total internal reflection.
- ⇒ In the optical fiber the rays undergo repeated total number of reflections until emerges out of the other end of the fiber, even if the fiber is bent.

Total internal reflection in optical fiber



Classification of optical fiber

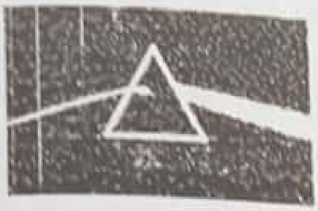
Optical fiber is classified into two categories based on:

(1) The number of modes, and

(2) The refractive index

Refraction

Refraction is the changing direction of light when it goes into a material of different density



On the basis of Refractive index

⇒ There are two types of optical fiber:

⇒ (i) Step-index optical fiber

⇒ (ii) Graded-index optical fiber

⇒ Step

How Optical Fibers are made?

⇒ Three Steps are Involved in the manufacturing of the optical fiber which are given below:-

— Making a Preform Glass Cylinder

— Drawing the Fibers from the preform

— Testing the Fibre

⇒ **Information source** – It provides an electrical signal to a transmitter comprising an electrical stage.

⇒ **Electrical transmitter** – It drives an optical source to give an modulation of the light wave carrier.

⇒ **Optical source**- It provides the electrical-optical conversion. It may be a semiconductor laser or an LED.

⇒ **Optical cable:** It serves as transmission medium.

⇒ **Optical detector:** It is responsible for optical to electrical conversion of data and hence responsible for demodulation of the optical carrier. It may be a photodiodes, phototransistor, and photoconductors.

⇒ **Electrical receiver:** It is used for electrical interfacing at the receiver end of the optical link and to perform the signal processing electrically.

⇒ **Destination:** It is the final point at which we receive the information in the form of electrical signal.

Advantage of optical fiber communication

(1) The life of fiber is longer than copper wire.
(2) Handling and installation costs of optical fiber is very nominal.
(3) It is unaffected with electromagnetic interference.
(4) Attenuation in optical fiber is lower than coaxial cable or twisted pair.
(5) There is no necessity of additional equipment for protecting against grounding and voltage problems.
(6) As it does not radiates energy any antenna or detector cannot detect it hence provides signal security.

Disadvantage

(1) Highly skilled staff would be required for maintenance.
(2) Only point to point working is possible on optical fiber.
(3) Precise and costly instruments would be required.
(4) Costly if under utilized.
(5) Accept unipolar codes only.
(6) Jointing of fiber and splicing is also time consuming.

Applications

⇒ Optical fibers have wider range of application in almost all fields, some are been specified below:

⇒ In telecommunication field

⇒ In space applications

⇒ Broadband applications

⇒ Computer applications industrial applications

⇒ Mining applications

⇒ In medical applications

⇒ In military applications etc.

MULTIPLE CHOICE QUESTIONS

COMPUTER

1. Name the simplest calculator that has been used for thousands of years. It is still used in some parts of the world toady. Calculators are made by moving the beads along the wires. It counts in tens.
(a) Abascus (b) Acabus
(c) Stonehenge (d) None of the above

2. What is meant by tallying?
(a) It is a method of matching. (b) It is a method of remembering
(c) It is a method of copying. (d) It is a method of counting.

3. Computers are the most modern equipments which use their own languages for the processing of information. One of the fundamental languages used in computers is BASIC. What is this abbreviated for?
(a) Built in Arithmetic System of Instructions Code.
(b) Beginner's Arithmetic System of Instruction Code.
(c) Binary Arithmetic System of Instruction Code.
(d) Binomical Arithmetic System of Instruction Code.

4. Computers use different programming languages. Which of the following is such a language?
(a) FORTAN (b) ALGOL
(c) COBOL (d) All the above.

5. BASIC is the most commonly interpreted language of the computers. Who developed this?
(a) Konrad Zuse (b) Kemeny and Kurtz
(c) John Von Neumann (d) Charles Babbage.

6. We often use the word Digit for each number in counting. Digit comes from the Latin word "Digitus" meaning as:
(a) Number (b) Numeral
(c) Finger (d) Thumb.

7. When you count in tens, you are counting in what is called a?
(a) Mathematical System (b) Decimal System
(c) Sexgesimal System (d) Logrithmic System

8. Binary System employed in computers use only two digits. What are those digits?
(a) 1 and 1 (b) 0 and 1
(c) 1 and 2 (d) 1 and 10

9. You can write your own programme with Yes or No questions on your computer. You can think of these steps as pairs of Gates. What is a collection of YES or No Gates called?
(a) Craze (b) Phase

[redacted]

(c) Maze
(d) Haze

10. Which of the following is an essential part of a pocket calculator?
(a) Display Panel
(b) Number Keys
(c) Command Keys
(d) All the above

11. Computers may be Analogue or Digital type. The digital computer actually counts. The word analogue means similar or like. The function of the analogue computer is only to:
(a) Compare
(b) Copy
(c) Immitate
(d) All the above.

12. Which of the following is not an example of General purpose analogue computers?
(a) Mechanical differential analyzer
(b) Electronic analogue computers.
(c) Digital differential analyzers.
(d) Simulators.

13. Which of the following is an example of special purpose analogue computer?
(a) Slide rule
(b) Planimeters
(c) Scale models
(d) All the above.

14. The earliest analogue computer was special purpose computer. Which of the following is not an example of such computers?
(a) Tide predictor
(b) Analytical engine
(c) Harmonic synthesizer
(d) Isograph.

15. What are hybird computers?
(a) Pure analogue computers
(b) Pure digital computers.
(c) A combination of analogue and Digital computer
(d) None of the above.

16. The computer of which of the following scientists were card sequenced – a sequence of arithmetic operation controlled by the reading of punched cards?
(a) Charles Babbage
(b) Lord Kelvin
(c) A.A. Michelson
(d) R. L. Dietzold

17. Hardware and software are more commonly used computer words. The different pieces of computer equipment are called hardware. What is a software?
(a) Memory
(b) Programme
(c) Digital display
(d) Printer

18. Which of the following is not an example of software?
(a) Magnetic tapes
(b) Floppy disks
(c) Hard disks
(d) All the above.

19. An integrated circuit is a group of electronic parts joined together in a protective case. It is also called as:
(a) Bit
(b) Chip
(c) Byte
(d) None of the above.

20. A chip is made from a very thin flake of an elemental material called:
(a) Iron (b) Aluminum
(c) Silicon (d) Copper.

21. Each digit in computer is called one bit short for binary digit. How many bits make a byte in most of the micro-computers?
(a) Eight (b) Eighteen
(c) Ten (d) Two

22. The memory of a computer is measured in bytes. Some computers have memories measured in megabytes. How many bytes make a megabyte?
(a) 1,048,576 (b) 1,038,476
(b) 1,028,376 (d) 1,058,676.

23. The largest computers are to be found in the head offices of banks and other large companies. Many of the bills (Electricity and gas) that arrive at our homes have been calculated and printed by such very big computers. What are such big computers called?
(a) Mainframes (b) Microcomputers
(c) Microprocessors (d) Minicomputers.

24. Which of the following is an essential part of a computer?
(a) Central processing unit (b) Control unit
(c) Arithmetic logic unit (d) All the above.

25. Which part of the computer is also called as the brain of the computer?
(a) Compiler (b) Central processing unit
(c) Visual display unit (d) None of above.

26. Which of the following is not an input device of a computer?
(a) Light pen (b) Keypad
(c) Mouse (d) Compiler

27. When you want to use your computer for word processing (means producing letters or stories), what input device must be used?
(a) Modem (b) Joystick
(c) Keyboard (d) Light pen.

28. Which input device is used for playing computer games?
(a) Mouse (b) Joystick
(c) Modem (d) Keypad.

29. ROM and RAM are commonly used terms in computers. What are these?
(a) Peripherals (b) Memories
(c) Input devices (d) Output devices.

30. Which memory of the computer is like reading a book?
(a) Randam Access Memonry (RAM)
(b) Read Only Memory (ROM)
(c) Both (a) and (b)
(d) Neither (a) nor (b).

31. Word processing is a way of using a computer to produce perfectly typed letters, o stories. The computer is usually loaded with a word-processing programme for th purpose. Which of the following can be used as a printer in this process?

(a) Dot matrix printer
(b) Daisy Wheel printer
(c) Laser printer
(d) All the above.

32. Bar code is a set of lines printed on the pockets of shop goods available in th Supermarket. The cashier of the store can know the price and the nature of the goo by doing what?

(a) Reading the bar code.
(b) Passing laser pen over the bar code.
(c) Counting the lines of the bar code.
(d) Touching his fingers to the bar code.

33. A database is information, or data on a disk or tape. If you link up with the comput that contains it, you can get the computer to do the searching many times faster tha you could do it yourself. Name places where databases are used.

(a) Libraries
(b) Hospitals
(c) Police headquarters
(d) All the above

34. What brings pages of information to your television screen from a central compute by using a databse?

(a) Viewdata
(b) Bar codes
(c) Teletext
(d) None of the above

35. Sometimes you see the picture in a newspaper or a magazine which is made of tin dots. In the same way a computer can display a picture made up of tiny points of ligh on a VDU screen. What are these pictures called:

(a) Ureal
(b) Virtual
(c) Viewdata
(d) Pixels

36. What is supercomputer?

(a) It has a single chip processor.
(b) It is an intermediate between a microcomputer and mainframe.
(c) It is the most powerful general purpose computer
(d) It is designed specifically for speed.

37. What is a computer programme?

(a) It is a series of codes instructions held as numbers.
(b) It is an input device
(c) It is an output device
(d) It is the brain of a computer.

38. What is 4 GL ?

(a) It is four gates locomotives
(b) It is fourth generation languages.
(c) It is four graphic lights
(d) None of the above.

39. When was IBM personal computer launched?

(a) 1979 (b) 1978

(c) 1977 (d) 1976

40. EDSAC (Electronic Delay Storage Automatic Calculator) containing 3500 values, was the first stored-programme computer in operation. When was this launched?

(a) 1944 (b) 1945

(c) 1946 (d) 1947.

41. Elliot 802 was the first computer to use transistor. What was the year?

(a) 1958 (b) 1957

(c) 1956 (d) 1955

42. Microprocessor was invented by Marcian F. Hoff. Who invented supercomputer?

(a) Jack Kilby (b) Edwards Roberts

(c) Seymour Cray (d) Paul Alien.

43. Earlier, data was fed into a computer using punched cards invented by Herman Hollerith. Who invented the ‘punched tape” programme for weaving textile designs automatically?

(a) Joseph-Marie Jacquard (b) Charles Babbage

(c) Grace Wopper (d) Irving Ziller

44. Which of the following computers is called “The grandaddy of the present computer”?

(a) UNTVAC (b) EDVAC

(c) ENIAC (d) EDSAC

45. MANIAC is the name of the computer which made the hydrogen bomb possible. Who created Maniac?

(a) Otto Harm (b) Leo Szilard

(c) Paul Alien (d) Lord Kelvin.

46. Which one of the following computer languages is the most easy to learn?

(a) FORTAN (b) COBOL

(c) BASIC (d) ALGOL

47. Which one of the following computer languages is an advanced language?

(a) PASCAL (b) FORTAN

(c) COBOL (d) ALGOL

48. “Silicon Valley” is also called as the paradise of soft-wares. Where is this situated?

(a) San Fransisco (U.S.A.) (b) Canterbury (U.K.)

(c) Sydney (Australia) (d) Montreal (Canada.)

49. Computer viruses are programes that enter into other programmes on the floppy, hard disk or the network and produce electronic disorder. When were these invented?

(a) 5 years ago (b) 10 years ago

(c) 15 years ago (d) 20 years ago.

50. There are viruses and pseudo viruses. The main difference between the two is that viruses are carried within other files, while pseudo viruses are distinct files by themselves. Which one of the following is an example of pseudo viruses?
(a) Trojans (b) Worms
(c) Time bombs (d) All the above.

51. Viruses are small programmes that act like parasites. They replicate themselves and attach to host programms. There are four kinds of viruses namely. Boot Infectors, System Infectors, Program Infectors and Data Infectors. About how many total number of viruses are known?
(a) 350 (b) 250
(c) 150 (d) 50.

52. Which one of the following is usual symptoms which warn that the system has been infected by computer virus?
(a) Files have unusual modification datas.
(b) System bombs frequently.
(c) Programs take longer times to launch
(d) All the above.

53. Computers are called shadows of human brains. Computers are in some ways better than brains. Which one of the following statements represents this school of thought?
(a) Both Computers and human brains can recall memories.
(b) Brain forgets more than the computer.
(c) Brain are more complicated than computers.
(d) Computers can remember vast amount of informations, work quickly and they seldom make mistakes.

54. What units of computers are called peripherals?
(a) Memories (b) Central Processing Unit
(c) Input and out put devices.
(d) Arithmetic Logic Units.

55. A computer circuit is made of transistors and other devices and control the flow of electricity. One group of circuits which is especially designed for the work of multiplication is called:
(a) AND Circuit (b) END Circuit
(c) TND Circuit (d) CND Circuit.

56. Computers are also used in medicines for curing diseases. There is a technique in which temperatures in various parts of the body are made to display different colours on television screen, Doctors get clues to certain disease conditions from the difference in temperature. What is this called?
(a) Holography (b) Thermography
(c) Photography (d) Pantography.

57. Computers beat human brains especially in speed. It works much faster. Below is given calculation rates which one of the following is correct?
(a) Man with pencil and paper 1/5 sec.

(b) Mechanical calculator 4/sec
(c) Medium speed calculator 200,00/sec.
(d) All the above.

58. Computer scientists have long dreamt of building machines that can think. There has been no success so far but there is hope in future. Which of the following terms is given to this property of the computers?
(a) Extra terrestrial Intelligence (b) Artificial Intelligence.
(c) Micro Intelligence (d) Macro Intelligence.

59. The most tangible and practical result of Artificial Intelligence research has been expert system. These are designed to help humans make decisions. Which one of the following is an essential components:
(a) A database (b) An inference engine
(c) A user interface (d) All the above.

60. Computer languages have developed over the years using different acronyms for different functions. Which among the following was the last to be developed?
(a) BASIC (b) FORTAN
(c) ALGOL (d) SNOBAL.

61. Who is said to be a computer literate?
(a) The one who is familiar with computers.
(b) The one who writes poetry on computers.
(c) The one who does not understand computers.
(d) None of the above.

62. Who was genius Blaise Pascal?
(a) A German Chemist (b) A French Mathematician
(c) An American Physicist (d) A Russian Astronomer.

63. Name the kind of a computer built in England in Prehistoric times. It was used as a calendar to keep track of Eclipses.
(a) Abacus (b) Number Cruncher
(c) Calculi (d) Stonehenge.

64. Charles Berbbage was an eccentric nineteenth century English Mathematician. He is famous for building the first machine that could do more than simple calculations. Name the machine.
(a) Analytical engine (b) Steam engine
(c) Difference engine (d) Diesel engine.

65. Computers have sometimes been called "Logic Machines". They have logic circuits and logic gates. Logic is a method of thinking or at least arguing, that proceeds in a step-by-step manner to a conclusion. Mathematic logic was used in the design of the computers. Who first developed the formal rules of logic?
(a) The Pakistanis (b) The Greeks
(c) The Romans (d) The Arabs

66. Boolean logic is a form of mathematical logic developed by the nineteenth century, English mathematician George Boole. In Boolean logic all problems can be solved by

reducing them to a string of yes or no, true or false choices. This logic is essential to the digital computer, which can only deal with:

(a) False choices
(b) No choices
(c) Twin choices
(d) Two choices.

67. What is Mark I?

(a) First classical computer.
(b) First true electronic computer.
(c) First mechanical computer
(d) First personal computer.

68. ENIAC (Electronic Numerical Integrator and Calculator) has a huge advantage over Mark I, for it used values in place of electromagnetic switches. It had 18,000 values. When did ENIAC make its first appearance?

(a) Late forties
(b) Late fifties
(c) Late sixties
(d) Late thirties.

69. Punched cads were used in early computers to:

(a) Feed data
(b) Give Programme
(c) Control calculations
(d) Read information.

70. What does "State of the Art" mean in technology?

(a) Up-to-data
(b) The best
(c) Latest available
(d) All the above.

71. A slide rule, in its simplest form is ruler with fixed and moving scales. By moving one scale relative to the other fairly complicated mathematical calculations can be worked out. Once it was the mark of the engineering and mathematic student but now it has virtually disappeared. When did the last U.S. manufacturer of slide rules go out of business?

(a) In 1950
(b) In 1980
(c) In 1960
(d) In 1990

72. How many bytes of memory a 16 K computer has?

(a) 13,84
(b) 14,384
(c) 15,384
(d) 16,384

73. Computers handle words in the same way they handle numbers. The letters of the words are translated into a binary code, so that each letter is represented by a particular string of 1s and Os. What is the code of most personal computers to represent the letter "A"?

(a) 01000001
(b) 0101001
(c) 11000001
(d) 00100001

74. Gates are the transistors that control the flow of electricity through the circuit They can send a pulse of electricity through the circuit or stop it, simply by switching on or off. They are called gates because different signals make them turn on or off. Which of the following is an example of gates?

(a) AND gate
(b) OR gate
(c) OR gate
(d) All the above.

75. Programmes of the computers are not written in English but they use special computer languages. Many of the terms in BASIC are based on English words and

common mathematical symbols. Which one of the languages is used to write mathematical programmes?

(a) EXPLOR (b) PILOT

(c) FORTAN (d) LOGO.

76. Which one of the following is not an example of small computer?

(a) Home computer (b) Personal computer

(c) Micro computer (d) Business computer.

77. What does the term "User friendly" means?

(a) It is jargon for easy to use.

(b) It is the description of a personal computer.

(c) The sort of machine an ordinary person feels comfortable with.

(d) All the above are true.

78. Floppy disc is a storage unit or memory unit, often used with small computers. It is made of plastic coated with magnetic substance. Floppy disc is called floppy because:

(a) It is made from a flexible plastic

(b) It is enclosed in a cardboard envelope.

(c) It is rotated at several hundred rotations per minute.

(d) It has read/write heads.

79. Which one of the following is new a development of the floppy disc?

(a) Mini-disk (b) Hard disc

(c) Diskette (d) None of the above

80. Hard disc works much the same way as a floppy disc but it can hold much more information, and naturally enough it is more expensive. What is hard disc made up of?

(a) Plastic (b) Wood

(c) Metal (d) Cardboard

81. How can pictures be drawn on a computer screen?

(a) With the help of keyboard (b) With the help of light pen.

(c) With the help of joystick (d) With the help of mouse

82. Photographs taken by satellites and space probes are often fuzzy and indistinct. These photographs can be scanned and analyzed by a computer program to clarify the details. These photographs are said to be:

(a) Computer synthesised (b) Computer animated

(c) Computer enhanced (d) Computer animated.

83. Which one of the following output devices is used for drawing diagrams, designs, pictures, patterns and symbols?

(a) Printer (b) Plotter

(c) Video display (d) None of the above.

84. A Robot has been called a computerised machine—a machine directed by a computer. The word Robot comes from a play entitled R.U.R (Rossum, Universal

Robots), written in 1921 by the Czech writer Karef Capek. What does the word Robot literally mean in Czech?

(a) Worker (b) Forced labour

(c) Man on hire (d) Both (a) and (b) are correct.

85. Which one of the following scientists is considered as the modern science fiction writer whose name is most closely associated with robots?

(a) Isaac Newton (b) Isaac Asimov

(c) Both (a) and (b) (d) Neither (a) nor (b)

86. ENIGMA was the name of a code making machine used during Second World War. With this machine it was possible not only to create codes but to change them frequently so that they could not be broken. This is how computers were used to break code. Who developed Enigma?

(a) Germans (b) British

(c) Americans (d) Japanese.

87. Computers have helped to create the Information Explosion which means that there is an awful lot of information around, more and more everyday. This is particularly true of scientific and technical information. When did this phrase of Information Explosion become popular?

(a) Late sixties (b) Late fifties

(c) Late forties (d) Late thirties.

88. What is meant by "Deepthought" in Science Fiction?

(a) It is the name of a computer book.

(b) It is the name of a popular TV show.

(c) It is the name given to the greatest computer in the Universe.

(d) It is the name of a science fiction writer.

89. What is a "Cyborg"?

(a) It is a combination of human being and machine.

(b) It is like the mechanical man with a human brain.

(c) It was the name of a science fiction movie.

(d) All the above are correct.

90. If you put faulty incomplete or silly data into, a computer you are going to get faulty incomplete or silly answers from the computers. What term is used for this?

(a) GIGO (b) CUBBISH

(c) KLUDGE (d) GRUFFY

91. Who called the human brain a "meat computer"?

(a) Charles Babbage (b) George Boole

(c) Marvin Mindky (d) Joseph Jacquard.

92. Slide rule is an example of:

(a) Digital computer (b) Analogue computer

(c) Mainframe (d) Microcomputer.

93. Punched tape was a modification of the punched cards. It made the information easier to get into the machine. The information was represented on the tape as patterns of

holes. It was developed for controlling weaving looms by Joseph Jacquard. What was the year?

(a) Early 1700s (c) Early 1900s
(b) Early 1800s (d) None of the above:

94. Which one of the following is a modern version of circuits used in computers?

(a) Electrical circuits (b) Printed circuits
(c) Integrated circuits (d) Magnetic circuits.

95. Integrated circuit consists of transistors, other electronic components and the connections between them is etched directly into small piece of silicon. Tiny integrated circuits are also called as microchips. When were integrated circuits first developed?

(a) Late forties (b) Late fifties
(c) Late sixties (d) Late seventies.

96. Computerese is partly technical language and partly slang used by computer engineers and enthusiasts. A computer that is working badly is producing:

(a) CUBBISH (b) GIGO
(c) KLUDGE (d) CRUFFY

97. Which country is still the leading nation in the design and manufacture of computers?

(a) England (b) Germany
(c) America (d) Japan

98. Modem is a special input device used in computers. It modulates or transforms computer information into a form that can be sent over phone lines or demodulates the whole process in the opposite direction. It makes possible for computers to communicate over the phone lines. What does Modem stand for?

(a) Money-demander (b) Modern-memory
(c) Modulation-demodulation (d) None of the above

99. Which one of the following computer industries is specifically engaged in the manufacture of video games?

(a) Apple (b) Radio Shack
(c) Commodore (d) Atari

100. What other things a word processor can do besides printing?

(a) Correct your spelling (b) Produce an index
(c) Prepare footnotes (d) All the above are correct.

KEY TO MCQs

1.	(a)	2.	(d)	3.	(b)	4.	(d)	5.	(b)	6.	(c)	7.	(b)
8.	(b)	9.	(c)	10.	(d)	11.	(d)	12.	(d)	13.	(d)	14.	(b)
15.	(c)	16.	(a)	17.	(b)	18.	(d)	19.	(b)	20.	(c)	21.	(a)
22.	(a)	23.	(a)	24.	(d)	25.	(b)	26.	(d)	27.	(c)	28.	(b)
29.	(b)	30.	(b)	31.	(d)	32.	(b)	33.	(d)	34.	(d)	35.	(d)
36.	(d)	37.	(a)	38.	(d)	39.	(a)	40.	(c)	41.	(b)	42.	(c)
43.	(a)	44.	(c)	45.	(b)	46.	(c)	47.	(b)	48.	(a)	49.	(d)
50.	(d)	51.	(a)	52.	(d)	53.	(d)	54.	(c)	55.	(a)	56.	(b)
57.	(d)	58.	(b)	59.	(d)	60.	(b)	61.	(a)	62.	(b)	63.	(d)
64.	(c)	65.	(b)	66.	(d)	67.	(b)	68.	(a)	69.	(a)	70.	(d)
71.	(b)	72.	(c)	73.	(a)	74.	(d)	75.	(c)	76.	(d)	77.	(d)
78.	(a)	79.	(b)	80.	(c)	81.	(b)	82.	(c)	83.	(b)	84.	(d)
85.	(b)	86.	(a)	87.	(a)	88.	(c)	89.	(d)	90.	(a)	91.	(c)
92.	(b)	93.	(c)	94.	(c)	95.	(b)	96.	(a)	97.	(c)	98.	(c)
99.	(d)	100.	(d)										

APPENDICES

SCIENTIFIC INVENTION AND DISCOVERIES

INVENTION/DISCOVERY	NAME OF SCIENTIST	INVENTION/DISCOVERY	NAME OF SCIENTIST
Aeroplane	Wright Brothers	Clock	Christian Huygens
Automobile	Daimler	Diesel Engine	Rudol Diesel
Atom Bomb	Otto Hahn	Dynamo	Michael Faraday
Atomic Theory	Democritus	Dynamite	Alfred Nobel
Atomic Number	Mosley	Dynamic Theory of Heat	Lord Kelvin
Airship	Graf Ferrdinand	Doctrine of Psycho-analysis	Freud
	Von Zeppelin	Electric Lamp	Thomas Addison
Bicycle	McMillan	Elevator	Elisha G. Otis
Barometer	Torricelli	Engine (Railway)	Bohr
Balloon	Montgolfier	Electronic Theory of Atomic Structure	Neil Bohr.
Battery and Current	Volta	Electrical Waves	Hertz
Cannon	Ermany	Electromagnetic Theory of Light	Maxwell
Cosmic Rays	R.A. Milikan	Electromagnet	William Sturgeon
Cordite	Dewer	Electrons	J.J.Thomson
Crescograph	J.C. Bose	Fountain Pen	Lewis E. Waterman
Cyclottron	Lawrence	Film and Photographic goods	Kodak
Circulation of Blood	Harvey	Film (Talking Movies)	Warner Brothers
Calculating Machine	Pascal	Founder of Homoeopathy	Hahnemann
Celestial and Terrestrial Globe	Mercator	Fahrenheit Scale	Fahrenheit
Chloroform	Harrison	Gramophone	T.A. Edison
Cellophane	J.E. Brandenberger	Motorcycle	Edward Butler
Celluloid	Alexander Parks	Neutron	Chadwick
Cement	Joseph Aspidin	Nylon Plastics	Carothers
Chronometer	John Harrison	Photography	
Gas Light	W. Murdock	(Colour)	Gabriel Lippman
Generator	Picinotti	Photography	N.R. Finseen
Glider	George Cayley	Printing Press	Caxton
Gum Powder	Roger Bacon.	Positron	Anderson
Hydrogen	Cavendish	Paints	Shalimar
Helicopter	Brequet	Periodic Table	Mendeleev
Hovercraft	Cockrell	Penicillin	Alexander Fleming
Helium gas	Lockyer	Quantum Theory	Plank

Inert gasses	Ramsay	Radar Razor (Safety)	R.W. Watt Gillette
Induction Coil	Rohmkorff	Revolver	Colt
Jet Engine	Frank Whittle	Radio	Markoni
Law of Gasses	Gay Lussac	Radio Transmitter	Alexanderson
Lenses and Camera	Zeiss	Radioactivity	Bacquerel
Laser	T.H. Mainman	Radium	Madam Curie
Laws of Gravitation and Laws of Motion	Newton	Refrigerator	James Harrison
Laws of Heredity Lightening	Mendel	Sewing Machine	Howe
Conductor	Benjamin Franklin	Submarine	Bushnell
Loudspeaker	Rice Kellogg	Seismograph	William Murdock
Laws of Diffusion	Fick	Steam Engine	James Watt
Motor Car	Henry Ford	Stethoscope	William Stockes
Microphone	A. Grahm Bell	Spectacles	Venice
Microscope	Zacharias Janssen	Telescope	Galileo
Machine Gun	Gattling	Theory of Evolution & origin of species	Charles Darwin
Malaria parasite	Ronald Ross	Tank	Swinton
Military tank	Swinton	Teleprinter	Smile Bandot
Telephone	A. Graham Bell	Telegraph	William cook
Television	J.L. Baird	Theory of Relativity	Albert Einstein
Transistor	William Shockley	Velocity of Light	Fizean
Typewriter	Christopher Sholes	Vitamin D	F.C. Hopkins
Telegraph Code	Samuel F.B. Morse	X-Rays	Roentgen

SCIENTIFIC INSTRUMENTS

Algesimeter	It is an instrument which indicates the degree of sensitiveness of the skin.
Altimeter	It is an aneroid barometer which is used in measuring altitudes (heights compared to sea-level).
Ammeter	It is an instrument used for measuring electric current.
Anemometer	It is an instrument used to measure the velocity of the wind and to find the directio of the wind.
Barometer	It is used for the measurement of the atmospheric pressure.
Chronometer	It is a clock-like device that shows accurate measurement of time, generally used on ships in navigation.
Cyamometer	This instrument is used for measuring blueness of oceans or sky.
Dasymeter	It is a device consisting of thin glass globe for determining density of gas.
Galvanometer	It is an instrument for detecting or measuring small electric current.
Hydrometer	It is used to determine the relative density of liquids.

Hygrometer	It is an apparatus for measuring relative humidity in atmosphere.
Hyposometer	It is an instrument used for measuring atmospheric pressure to ascertain elevations by determining boiling point of liquid.
Keratometer	It is an instrument by which the amount of corneal astigmatism can be measured accurately.
Lactometer	It is an instrument used for measuring the purity of the milk
Manometer	It is an apparatus used for measuring the pressure of gases,
Micrometer	It is a scale for measuring minute distances or angles
Perimeter	The measure of the distance around the outside of a shape. OR The distance around a figure
Periscope	It is an optical instrument used for viewing objects above the eye-level of the observer It is used in submarines
Pyrometer	It is a specially designed thermometer to measure high temperatures.
Refractometer	It is used to measure the refractive index of a substance
Spectrometer	It is a type of spectroscope used for spectrum analysis.
Seismograph	It is an instrument which is used to record the intensity and origin of earthquake
Sphygmomanometer	It is an instrument which is used to record the blood pressure
Telemeter	It is an apparatus for recording physical event happening at a distance.
Telstar	It is an instrument to transmit wireless or television broadcast more distinctly across continents via space
Viscometer	It is used to measure the viscosity (resistance to flow) of liquids.
Voltmeter	It is an instrument used to measure potential difference between two points in an electric circuit.

THE WORLD

Map	It is a drawing to show the shape arid features of a place on a two dimensional paper
Magnetic compass	It is an instrument for finding the direction of a place.
Grid System	A system of grid lines.
Grid Reference	A system of Grid Lines.
Grid Reference	It is a figure given to a point on map where two grid lines intersect.
Important Latitudes	Tropic of cancer 23-1/2°N, Tropic of Capricorn 23-1/2 °S Arctic circle 86-1/2°N, Antarctic circle 86-1/2°S.
International Date	It is 180° line of Longitude. The two sides of the line have a difference of one

Line	day.
Prime Meridian	It is 0° line of Longitude passing through Greenwich.
Rotation of the Earth	The Earth takes one complete rotation on its axis (it is a line around which an object spins) in 24 hours and it forms days and nights. Because the axis of the Earth is inclined at an angle of 23-1/2° from the vertical, therefore, distribution of day and night time is uneven.
Revolution of the Earth	The Earth makes one complete revolution round the Sun in about 365-1/2 days or one year. The 1/4 day is added up to give an extra day in a leap year, which is once every four years.
Important points of Revolution	Summer solostice ff 21st June; Winter Solastice ff 22nd December spring Equinox ff 21st March; Autumn Equinox ff 23rd September.
Weather	Weather is the condition of the atmosphere. Elements of weather are; Temperature, Pressure, wind, precipitation and Humidity.
Climate	Climate is the average weather conditions of a place over a long period of time. Different climate zones of the world are; cold, temperate, subtropical and tropical.
Time Zones	Since there are altogether 360° of longitude, and the Earth takes 24 hours to turn round once, it takes one hour to turn 15°. Each 15° of longitude, therefore, differs from the next 15° by an hour. This difference is used to mark the time zones in the world. Standard time zones of America are Atlantic, Eastern, central. Mountain, Pacific and Alaska Times.

HUMAN PHYSIOLOGY

1.	The largest organ of the body.	Skin
2.	The total No. of bones in an adult.	206
3.	The hardest bone in the human body.	Tooth
4.	The largest gland of the body.	Liver
5.	The longest bone of the body.	Femur
6.	The smallest bone of the body.	Stapes
7.	Total number of muscles in the body.	600
8.	Total No. of orders of Levers in the body.	Three
9.	The filter of the body.	Kidney
10.	The Pump of the body.	Heart
11.	The normal body temperature.	37°C (98.4°F)
12.	The normal respiratory rate in an adult.	16-18 per min.
13.	Average age of onset of puberty in males.	12-15 years.
14.	Average age of onset of puberty in females.	12-14 years.

15.	Average total volume of the blood in an adult.	4.5-5 litres
16.	Total number of bones in the face.	14
17.	The lid of the alimentary canal.	Epiglottis
18.	Total number of bones in the neck.	7
19.	Total number of bones in the Wrist.	8
20.	A stage when excessive heat loss occurs.	Hypothermia
21.	The narrowest part of the alimentary canal.	Oesophagus
22.	Spontaneous response without will of the body.	Reflex action
23.	A male who is unable to reproduce.	Aspermic
24.	Vascular connection between foetus and uterus.	Placenta.
25.	Process of which mammary glands secret milk.	Lactation
26	Total number of bones in the vertebral column.	33

EFFECTS ON EARTH

ROTATION OF THE EARTH:

The Earth is like the vast wheel which rotates around its axis from West to East once in 24 hours. This motion of the Earth is called the Spinning or Rotation. The most important effect of the Rotation of the Earth is as follows.

No.	Effects
1.	Days and Nights are produced.
2	Sun appears to rise from the East and sets in the West.
3.	It gives sense of time; morning, noon, evening and night.
4.	Gives understanding of longitudes.
5.	The Earth bulges out at the Equator.
6.	The Earth acts as a Huge Magnet.
7.	The Earth acts as a Churner of the Terrestrial water.
8.	Different time zones are formed.
9.	Deflection of the usual direction of winds and currents.
10.	North, South, East and West sides are fixed.
11.	International Date Line is fixed at a longitude of 180°

TILT OF THE EARTH:

The axis of the Earth is inclined at an angle of 66.5° to the plane of its orbit or the axis of the Earth is tilted to an angle 23.5° to the horizontal. This is called the tilt of the Earth or the obliquity of the Earth's axis. Its important effects are as follows:

No.	Effects
1.	Days and Nights are of unequal length.
2.	Formation of Four Seasons.
3.	The Seasons in the Hemispheres are different.
4.	The altitude of the Midday Sun varies at different periods of the year.

Revolution of the Earth

The Earth revolves round the Sun and completes one revolution in 365.25 days. This motion of the Earth is called Revolution and Annual Motion. Its important effects are as follows:

No.	Effects
1.	Distance of the Earth form the Sun changes during the year.
2.	Formation and change of one Season to other.
3.	Formation of different climatic zones like Temperate, Torrid, and Frigid.
4.	Equinoxes are formed like Spring Equinox (Mar. 21) and Autumn Equinox (Sept. 22).
5.	Solstices are formed like Summer Solstice (Jun. 21) and Winter Solstice (Dec. 22).

FANCY – PLACES

Sr.No.	Fancy Names	Places
1.	Pearl of Africa	Uganda
2.	Cockpit of Europe	Belgium
3.	Land of the Rising Sun	Japan
4.	Roof of the World	Tibet or Mighty Himalayan
5.	Paradise of Softwares	Silicon Valley
6.	Tear of India	Sri Lanka
7.	Golden State of U.S.A.	California
8.	Land of Opportunities	U.S.A.
9.	Gateway of British India	Khyber Pass
10.	Garbage of Europe	Greece
11.	Sick Man of Europe	Turkey
12.	Manchester of Pakistan	Faisalabad
13.	Big apple of U.S.A.	New York
14.	Sun shine State of U.S.A.	Florida
15.	Melting Pot of U.K.	Ireland
16.	Sugar Boul of the World	Cuba
17.	City of Golden Gate	San Francisco
18	Uncle Sam	U.S.A.
19.	Land of Midnight Sun	Norway
20.	Nation of Immigrants	U.S.A.
21.	Play ground of Europe	Switzerland

22.	Road of Conquest and Culture	Grand Trunk Road
23.	Venice of the East	Bangkok
24.	City of Seven Hills	Rome
25.	Land of Thousand Lakes	Finland
26.	Third World	South East Asian Countries
27.	K-2	Second Highest peak of Karakoram
28.	Troubled Heart of Central America	Nicaragua
29.	Pearl of Siberia	Russia's Lake Baikal
30.	Mirror of India	New Delhi

SOME COMMON STAINS AND STAIN REMOVERS

Stain	Stain Remover Chemical
Antiperspirants	Ammonium hydroxide
Asphalt	Benzene, carbon disulfide
Berry (fruit)	Hydrogen peroxide
Blood	Cold water, hydrogen peroxide, sodium hypochlorite
Chocolate	Tetrachloroethylene
Coffee	Sodium hypochlorite
Grass	Amyl acetate and benzene (50:50) or sodium hypochlorite or alcohol
Ink	Oxalic acid, methanol, water
Lipstick	Isopropyl alcohol, isoamyl acetate, chloroform
Mildew	Hydrogen peroxide, sodium hypochlorite
Mustard	Alcohol, sodium hypochlorite
Nail polish	Acetone
Perspiration	Ammonium hydroxide, hydrogen peroxide
Rust	Water, methanol, oxalic acid
Scorch	Hydrogen peroxide
Soft drinks	Sodium hypochlorite
Tobacco	Sodium hypochlorite

DO YOU KNOW?

1. Your body needs five types of fiber: Cellulose, Hemicellulose, Lignin, Pectin and Gums.
2. A cup of Yogurt has more potassium than a banana.
3. Vaccines trigger the Body's Immune System.
4. The human eye can retain its last image after death.

5.	God does not play dice with the Universe.
6.	The human body odour is the result of about 450 different volatile organic compounds emanating through the skin.
7.	More than 40,000 drugs contain Aspirin.
8.	Trees are nature's air-conditioning units.
9.	Trees act as Lungs for the Earth.
10.	Deep-sea cold water fish is a natural source of OMEGA-3 polyunsaturates: a substance that dissolves CHOLESTEROL in human body.
11.	The glycemic index measures how fast a carbohydrate raises blood sugar.
12.	A person's memory holds about 100 trillion bits of information in its lifetime.
13.	Human blood serum is almost identical with sea-water.
14.	A baby has about 144 more bones than in an adult.
15.	Bermuda Triangle continues to remain a mystery of the Atlantic Ocean.
16.	Lighting is one of the Nature's grandest and most dangerous spectacles.
17.	Lightning pattern occurs but once in an Eternity.
18.	CFCs can float for about one hundred years in the atmosphere un-decomposed.
19.	Bacilli Calmette Guerin (BCG) is a Vaccine against TB.
20.	The genetic script inside human cells has been written by 2 billion years of evolution.

NOBEL PRIZE WINNERS 2015

NOBEL PRIZE IN PHYSICS

Takaaki Kajita and Arthur B. McDonald

"for the discovery of neutrino oscillations, which shows that neutrinos have mass"

NOBEL PRIZE IN CHEMISTRY

Tomas Lindahl, Paul Modrich and Aziz Sancar

"for mechanistic studies of DNA repair"

NOBEL PRIZE IN PHYSIOLOGY OR MEDICINE

William C. Campbell and Satoshi Ōmura

"for their discoveries concerning a novel therapy against infections caused by roundworm parasites"

Youyou Tu

"for her discoveries concerning a novel therapy against Malaria"

NOBEL PRIZE IN LITERATURE

Svetlana Alexievich

"for her polyphonic writings, a monument to suffering and courage in our time"

NOBEL PRIZE IN PEACE

National Dialogue Quartet

"for its decisive contribution to the building of a pluralistic democracy in Tunisia in the wake of the Jasmine Revolution of 2011"

SVERIGES RIKSBANK PRIZE IN ECONOMIC SCIENCES IN MEMORY OF ALFRED NOBEL

Angus Deaton

"for his analysis of consumption, poverty, and welfare"

SOME FAMOUS MUSLIM SCIENTISTS

(1) Muhammad bin Musa Al-Khawarizmi

He was born (A.D. 780-847) in Khawarizm. He was one of the greatest scientists of all times and contributed richly in the field of Mathematics, Astronomy and Geography. He was considered as an authority on mathematics. He composed the oldest works on arithmetics, algebra and astronomical tables. He actually systematised the Greek & Hindu mathematical knowledge. His celebrated work on algebra entitled "Hisab al Jabr Wal Muqabala" translated in Latin, was used as the principal mathematical text-book until the 16th century by European universities. He was an astronomer of outstanding ability. He was also a geographer of repute and laid the foundation of geographical science in Arabic. He has been called "the principal figure in the early history of Arabic Mathematics". He wrote a great treatise on Algebra containing analytical solutions of quadratic equations. He authored the following important books:

MUHAMMAD BIN MUSA AL-KHAWARIZMI

(i)	Hisab Al Hindi
(ii)	Al Jama-Wat Tafri
(iii)	Kitab al Amal bil Asturlab
(iv)	Kitab Ama of Asturlab
(v)	Kitab Surat al Ard

(2) Jabir Ibn Hayyan

Jabir Ibn Hayyan (A.D. 721-815) known as Geber in the West, was a great practical chemist of his time. He prepared a large number of important chemicals like, Nitric Acid, Sulphuric Acid and Hydrochloric Acid. He is considered as god-father of modern chemistry. He became famous for his various chemical techniques and processes like, calcination, reduction, sublimation, distillation, melting and crystallization. Several of his chemical treatises were translated into several European languages. He gave sound views on methods of chemical research, and a theory on the geological formation of metals. He prepared basic lead carbonate, arsenic and antimony from their sulphides; dealt with refinement of metals, preparation of steel, dyeing of cloth and leather. He authored the following important books:

JABIR IBN HAYYAN

(i)	Kitab al Rahmah
(ii)	Kitab al Tajmi
(iii)	Book of Seventy

(iv)	Composition of Alchemy

(3) Abu Ishaq Kindi

Al-Kindi was born in Basrah in the beginning of the 9th century AD. He was a great physicist, known as Al-Kindus in the West. He wrote a treatise on geometri-cal and physiological optics. He also endeavored to ascertain the laws that govern the fall of bodies. No less than 265 works are ascribed to him of which at least fifteen are on meteorology, eight on music and several on specific weights, tides, optics and on the reflection of light. His important treatises are:

(i)	De Aspectibus
(ii)	De Medicinarum Compsitarum Gradibus

(4) Zakariya al-Razi

Abu Bakr Muhammad Ibn Zakariya Al-Razi (A.D. 865-925) was a Persian Muslim and a great physician by profession. He is better known as Rhazes in the West. His other fields of interest were physics and chemistry. He was the most brilliant pillar of Islamic medicine alongwith Ibn Sina. He also contributed in the fields of music, philosophy, mathematics, astronomy and ethics. He earned the title of the Father of Paediatrics by writing his monograph on **"Diseases in children".**

He believed in five eternal principles in metaphysics namely Creator, Soul, Matter, Time and Space. He was also an excellent teacher of medicine. He made an attempt to classify chemical substances. He was the first scientist to classify substances into vegetables, animals and minerals.

His famous books are:

(i)	Arabian Medicine
(ii)	Al Hawi
(iii)	Kitab Al Mansuri
(iv)	Al-JudariWal Hasbah
(v)	Kitab Al Asrar
(vi)	Barr-ul-Saat
(vii)	Kitab Al-Asrar
(viii)	Fi Janial il Musuqi

(5) Abu Ali Sina

Abu Ali Hussain Ibn Abdullah Ibn Hasan Ibn Ali Ibn Sina was born in A.D. 980 at Afshinah near Bukhara (Turkistan). He is considered as the greatest intellectual giant of the Middle Ages. He contributed to medical science, philosophy, logic, mathematics, astronomy and music. He was an unforgetable physician of all times. He is better known a Avicenna in the West. His most famous book (Al-Qannun fil Tib', known as Canon in Latin, was translated in many languages and it remained the sole text book of medicine for several hundred years in Western Universities. He was unparallel versatile genius. It is said that he wrote no less than 230 books and treaties. He fell victim to a disease in which he was a specialist and breathed his last at the age of 57 in A.D. 1037. The Canon of a Avicenna, consisting of approximately a million words, is the most influential text-book ever written. For six centuries it dominated the medical schools of Asia and Europe. He was the first to use catheters made of the skins of various animals, and he mentioned intravesical injections by means of a silver syringe.

His famous books are:

(i)	Ash-Shfa
(ii)	An-Najat
(iii)	Nafia
(v)	Isharrat

(6) Al-Biruni

Abu Kayhan Muhammad Al-Biruni was born near the town of Khawarizm in A.D. 973. He was simultaneously a physician, astronomer, mathematician, physicist, geographer and historian. He was a born writer and he never had a pen out of his hand. He learnt Sanskarit language in order to investigate Indian knowledge. He explained the problems of advanced trigonometry. It was he who discovered that light travels faster than sound. He accurately determined the weight of 18 stones in physics. He gave an understanding to the terms of longitudes and latitudes. He died at the age of 75 years in A.D. 1048. He was the author of the following famous books.

(i)	Tahqiq Al Hind
(ii)	Qanun Al Masudi
(iii)	Asrar Al Baqiya

(iv)	Kitab Al Saidana
(v)	Kitab Al Jawahar
(vi)	Al Tafhim

(7) Ibn Al-Haitham

Abu Ali Al Hasan Ibn Al-Haitham, better known as Alhazan in the West, was born at Basrah in A.D. 975. He was an outstanding mathematician, physiologist and optician. He is more known for his optical works which were translated into Latin. He explained the refraction of light rays through transparent objects, discovered magnifying lenses, and the function of retina as the seat of vision. He identified gravity as a force, a theory which was later on developed by Newton. He died in Cairo in A.D. 1039. He ob served the semi-lunar shape of the image of the Sun during eclipses on a wall opposite a fine hole in the window-shutters-the first record of the camera obscura. His famous books are:

(i)	Uyunul Ariba fi Tabaqaat il Atibba
(ii)	Kitab Al Manazir
(iii)	On twilight Phenomena
(iv)	Mizanul Hikma
(v)	Configuration of the Universe

(8) Ibn Al-Baitar

IBN AL-BAITAR

Abu Muhammad Abdullah Ibn Ahmad Al-Baitar was born in Malaga (Spain) at the end of the 12th century. He was a great Spanish Muslim botanist and pharmacist. He made a complete collection of plants and herbs extending from Spain to Syria. He discovered many new plants and extracted medical drugs from them. His work was considered an authority in plants and he gave new orientation to the classification and nomenclature of plant kingdom over which modern botany is based. He died in Damascus in A.D. 1248. He was the author of the following famous books:

(i) Kitab Al-Jami fi Adwiya Al Mufzada
(ii) Jami
(iii) Mughani

(9) Ibn Rushd

Abdul Waleed Muhammad Ibn Ahmed Ibn Muhammad Ibn Rushd was born in Spain in A.D. 1126. He is better known as Averroes in the West. He contributed in philosophy, mathematics, medicine, astronomy, logic and Islamic Jurisprudence. He was an authority on Fiqh. He investigated astronomy at length and discovered the sunspots. He died in A.D. 1198. His famous books are:

- *(i)* Hidayat Al-Mujtahid Wa Nihayat Al Muqtasid
- (ii) Kitab Fi Karkal Al Falak
- (iii) TahafutAl-Tahafut
- (iv) Kitab Fasl Al Maqal
- (v) Kitab Al Lashf Al Manahij

(10) Al Mawardi

Ali Ibn Muhammad Ibn Habib, Abul Hasan Al-Mawardi was born at Basrah in A.D. 1058. He was a learned jurisconsul and political economist. He was an expert on diverse subjects like religion, ethics, literature and politics. He died in A.D. 1123. He was author of the following famous book.

(i)	Al Bayan Wat Tabiyan
(ii)	Al Hawi
(iii)	Nukat–Wal Uyum
(iv)	Al Iqna
(v)	Al Ahkam Us Sultaniyah

(11) Nasir Al-Din Toosi

Nasir Al-Din Toosi was born in A.D. 1201 in Toos. He contributed in the fields of astronomy, mathematics, optic geography, medicine, philosophy, logic, music, mineralogy and ethics. He was a versatile scholar and astrologer. He go built the Maragha observatory for astronomical researches He was also an expert on mathematics and he earned great popularity by writing "The Ilkhanian Tables". This work is divided into four books namely, *(i)* CHINESE, GREEK, ARABIC AND PERSIAN CHRONOLOGY *(ii)* MOTIONS OF THE PLANETS, *(iii)* EPHERMERIDE and *(iv)* ASTRONO-MICAL OBSERVATIONS. He died in Baghdad in AD. 1274. He wrote a treatise on the Quadrilateral, "a work in which Trigonometry, Plane and Spherical", found its first methodically developed and deliberate expression. His other famous books are:

(i)	Kitab Al Tazkira Al Nasirya
(ii)	Kitab Al Tahsil Fil Najum

(iii)	Kitab-i-si-Fasl
(iv)	Qawaid Al-Handasa
(v)	Kitab Shakl Al Qatta
(vi)	Kitab Al Fusul

(12) Abul Qasim Al-Zahrawi

Abul Qasim Al-Zahrawi, better known as Mamoon of the West, was born in A.D. 936 in Spain. He was a great surgeon He invented many surgical appliances, never known before. He was a physician as well. He was an excellent dentist also and he could very successfully set an artificial tooth in place of diseased. He gave perfection to the surgical science. He died in A.D. 1013. He was the author of the following famous book:

(i)	Al-Tasrif

(13) Al-Battani

Abu Abdullah Muhammad Ibn Jabir Al-Battani, a great Arab Astronomer and Mathematician, was born around A.D. 858. He widened the scientific horizons of Astronomy beyond the Greek's metaphysical concepts. He was an excellent observer of Lunar and Solar Eclipses. He had a great command in Trigonometry and he established the relation between the sides and angles of a spherical triangle. He explained the phenomenon of Equinoxes (the time when the Sun crosses the equator thus equalising the length of day with night). He also prepared the Islamic Islamic Lunar Calendar. He died in A.D. 929. His famous book was "Kitab Al-Zig".

SUBJECT-WISE READY-RECKONER OF MUSLIM SCIENTISTS

Sr. No.	Subject	Name of Scientists who contributes
1.	Mathematics	Al Kindi, Al-Khwarizmi, Al-Fazari and Al-Nasavi.
2.	Geometry	Hajjaj Ibn Yusuf, Banu Musa, Abut Wafa, AL-Mahani, Abu Kamil Al Sijzi, Al Baghdabi, Abdul Faraj, Abd-ul-Malik, Al Shirazi, Muhammad Ibn Al-Hussain and Kamal-ud-Din Yunus.
3.	Aljebra	Al-Khwarizmi, Abu Kamil, Umar Khayyam Abu Wafa and Umar Ibn Ibrahim.
4.	Trigonometry	Habash-al-Hasib, Ibn Yusuf, Nasir-ud-Dm Al-Tusi, Al Zarqali and Hasan-al-Marakushi, Al-Battani.
5.	Astronomy	Habash al-Hasib, Abu Said al-Darir, Al-Farghani, Abdur Rahman

		al-Sufi, Ibn Yusuf, Ibn Al-Haitham, Umar Hayyam, Al Ghazali, Al-Zarqali, Banu Amajur, AL-Khwarizmi, Ibn-Rushd, AL-Bitruji, Qutb-ud-Din, Al-Shirazi, Al-Ibn Umar-al-Katibi, Al-Hasan Al-Marakushi.
6.	Natural History (Botany and Zoology)	Abu Ubaidah, Al-Asma, Al-Jahiz, Muhammad AL-Dimhyari, Al-Bakri, Abdul Latif, Al-Ghafiqi, Ibn Sina, Ibn Sun and Al-Idrisi.
7.	Chemistry	Jabir Ibn Hayyan, Al-Jahiz, Abu Mansur Muwaffaq, Abdul Qasim, AL-Razi and Hasan AL-Rammah.
8.	Physics	Al-Kindi, Banu Musa, Al-Jahiz, Al-Narizi, Al-Beruni, Ibn Sina, Al-Razi, Ibn Jami, Al-Kahin-al-Attar Abdur Rehman Ibn Nasi, Qaisar-Ibn Abi-al-Qasim.
9.	Optics	AL-Kindi, Ibn-al-Haitham, Nasir-ud-Din al Tusi, Al-Shirazi, Qutb-ud-Din, Kamal-ud-Din Farisi.
10.	Geography	Ibn Sarafyun, AL-Mas'udi, Al-Istakhti, Ibn-Haukal, abdul fida, AL-Beruni, Al-Farghani, AL-Kindi, Abdul Latif, Al-Idnsi, Hasan-al-Marakashi.
11.	Medicine	AL-Kindi, Zakariya Razi, Ali Ibn Abbas, Abul Qasim al-Zahrawi, Ibn-at-Haitham, Ibn al-Wafid, Ammar, Ali Ibn Isa, Ibn Sina Ibn Zuhr, Abdul Latif, Ibn-al-Nafis and Ibn-al-Baitar; Abu Ali Sina, Abu Mansur Muwaffaq.
12.	Scientific Instruments	Ibrahim al-Fazarum Muzaffar al-Tusi, Al-Badi, AL-Asturlabi, Tabin Ibn Aflah, Qaisar Ibn abial-Qasim Ibrahim Ibn Said al-Sahli Muhammad Ibn Hilal.

CENTURY-WISE READY-RECKONER OF MUSLIM SCIENTISTS

Century	Muslim Scientists
8th	Abu-Ubaidah, Jabir Ibn Hayyan, Al-Khawarzimi, Al-Fazari, Abdur Rahman Al-Sufi.
9th	Al-Kindi, Al-Farghani, Zakariya-al-Razi, Al-Battani, Al-Masudi, Al-Faraghni.
10th	Abu Ali Sina, AL-Biruni, Ibn Al-Haitham, Abul Qasim Al- Zahrawi, Al-Farabi.
11th	Al-Mawardi, Al-Zarqal, al-Khazini Ibn Zuhr, Al-Ghazali.
12th	Ibn Al-Baitar, Ibn Rushd, Ibn-ul-Baytar, Abdul Latif, Umar-al-Khayyam Hasan-al-Marakushi, Nasir ud-DIn al Toosi.

Nature of Science:

Science is used in a narrower sense to denote an ordered knowledge based on observations and experiments, excluding such humanistic studies as language, sociology, economics and political history. Science gives a comprehensive and meaningful picture of what we perceive by senses in so far as it can be expressed in terms of numbers, ratios, sizes, shapes, weights and motions and all the qualities and units derived from these. Science could not be advanced by more speculation as thought by the Greek philosophers; it is only sure progress lies in the partial interrogation of Nature. The first step towards scientific achievement is that of observation and experiment. It was by this step of observation and experiment that the followers of Islam gave science its true characteristic which the pre-Islamic world was totally unaware of. The essential characteristics of the scientific method are experiments, observations and inferences which happen to be parts of a spiral ladder of understanding science. The conclusions drawn in science are always subject to revision in the light of newly discovered facts.

SCIENTIFIC METHODS

Classical approach splits scientific methods into the following steps for the establishment of the true identity of a fact.

(1)	**Perception:**	It is the recognition and knowledge of the objects, produced by their contact with various external sense organs such as those of sight, hearing, touch, taste, smell and with internal sense organs such as the mind.
(2)	**Inference:**	It is the knowledge of the objects through the apprehension of some mark which is invariably related to the inferred objects.
(3)	**Comparison:**	It is the knowledge of the phenomenon or the object obtained by the establishment of a relation between a name and the object so named, or between a word and its connotation.
(4)	**Testimony:**	It is a method of establishing the identity of an object i.e., the knowledge of the perceived and unperceived objects derived form the statement of authoritative sources.

The wheel of time has now changed the classical approach into the following steps of modern scientific methods.

(1)	RECOGNITION OF THE PROBLEM
(2)	EXPERIMENTATION
(3)	OBSERVATION OF FACTS AND THEIR GROUPING
(4)	FORMATION OF HYPOTHESIS, AND
(5)	VERIFICATION OF HYPOTHESIS AND FORMATION OF THEORY

IMPACT OF SCIENCE ON SOCIETY

Once considered odd and Alien, science has now become the part of everybody's life. Every citizen is directly and vitally concerned with science. The development of science has changed the life-style gating habits, nature of sports and recreations. The impact of science on modern life can be discussed under the following headings.

Importance of Science:

Science means knowledge and it has two objectives to enable men to do and to know. Science has evolved out of philosophy, culture, mythology and religion. In the past, science has remained a pursuit of the learned but more recently, it has become an important factor in determining the everyday life of the common man. There is hardly any sphere of life where science, is not serving like curing diseases, preserving our food, warming us in winter, cooling us in summer, building our houses transporting us on land and water and helps us day and night in a hundred different ways.

Scope of Science:

The spectrum of modern science now extends from Astronomy to Zoology, from spiraling galaxies to the heart of atom, from microchips to the mechanisms of human body and from non-living things to living ones. Every discipline of science has developed so much that it needs to be further classified. Science deals with interaction of bodies with outside forces. It tells us how the bodies react to forces but it cannot tell how they respond. No branch of science however deals with consciousness, purpose, intention, will, wisdom and morality. Modern psychology and even decision making is becoming scientific. Science has become a culture, an attitude or simply a way of life.

Applications of Science:

Applications of Science are almost countless. It is making our lives comfortable and happier. Electricity has appeared as the most popular and obedient form of energy. Antibiotics have produced a revolution in controlling the spread of disease. Modern ways of transportation has must made all parts of the world more accessible. Genetics, test-tube babies, levitating trains, superconductivity and micro-computers are the emerging faces of the applications of science-these discoveries have thrilled our lives in all dimensions. The biggest application of science is that it is unfolding the secrets of nature which were locked in a mystery for the last hundred thousand years.

Horrors of Science:

Science is a double-edged weapon. It is useful and good on one hand and dangerous on the other. Population explosion, massive malnutrition, threat of nuclear and biological weapons and industrial pollution constitute the hit-list of horrors of science. It has made man more powerful to destroy his fellows. The atomic and hydrogen bombs continue to threaten human life. Science has made life hectic, complicated, noisy and full of violence. In spite of these disadvantages, science can go a long way in decreasing human misery and sorrow and increasing human happiness.

Limitations of Science:

Science cannot teach morals and so it cannot improve the ethical side of man's nature. Ethical moral values of life have always been governed by the strings of religion throughout the ages. It cannot solve the problem of large scale crimes, drug addiction and alcoholism. Science has no conscience, no feelings and no sympathies — just facts and figures. Science cannot tell us what we should do. It is we who have to decide what to do; the science will tell us how to do it and what will happen when we have done it.

EXERCISE

Q. **Name some important discoveries of Pre-Science era?**

Ans. Fire and Language are the most important discoveries of Pre-Science era.

Q. **What has been the main sequence for the development of Science over the years?**

Ans. The main sequence for the development of science goes around three stages, namely Imagination, Creation and Application.

Q. **What were the special characteristics of Muslim Scientists?**

Ans. Greek Science was mainly theoretical because it was not based on observation and experiments. Muslim scientists gave science its real meaning by switching over to its practical aspects: observation and experiment. They **realised** from the inquiring spirit **of the Holy Qur'an,** that science could not **be advanced** by more speculation, its only wire progress lay in the practical interrogation of Nature. The essential characteristics of their method were experiments and observations. The solution of a problem, regarding Mechanics, Hydrostatic or Optics, was always obtained by performing an experiment, or by an instrumental observation. It was this that made them the originators of Chemistry which led them to the invention of all kinds of apparatus for distillation, fusion, filtration, etc. They developed divided instruments like Quadrant and Astrolabe in Astronomy.

Q. **Discuss the contributions of Muslim Scientists in the development of Mathematics, Chemistry and Medicine.**

Ans. **A. Mathematics:**

Mathematics is the fundamental branch of Knowledge and mother of all sciences. Muslim scientists had **a great** deal of contribution to the development of this arithmetic notation. The figures which appear at the top of these pages are signs derived from Islam and not **from** the Roman numerals. They introduced **zero** which gave a new impetus to mathematics as a science as a science of abstract speculation. The conception of zero, connected as it is with the system of positional numeration, is one of the chief contributions of Islamic science to the West-Some of the Muslim mathematicians, who played a" very important role in introducing the new system of numeration into Europe, may be mentioned as Muhammad Ibn Ibrahim Al-Fazin, Al-Kindi, Al-Khwarizmi and Al-Nasavi, Al-Nasavi introduced the decimal system in place of sexagecimal system. Barton has observed that at the beginning of the 12th century it was almost impossible to become a full-fledged mathematician and astronomer without a good knowledge of Arabic.

(B) **Chemistry**

Jabir Ibn Hayyan gave sound views on methods of chemical research, and a theory on the geologic formation of metals. He prepared basic lead carbonate. Arsenic and Antimony from their sulphides; dealt with refinement of metals, preparation of steel, dyeing of cloth and leather. A number of his works on chemistry have been published by Berthelot.

Abul Qasim explained the preparation of drugs by sublimation and distillation. Al-Razi made an attempt to classify mineral substances into vegetables, animals and minerals. Al-Jahiz tried to classify mineral substances and Abu Mansur Muwaffaq described the preparation and properties of mineral substances. The Arabs manufactured inks, lacquers, solders, cements, imitation pearls and jewels. The Arabs are also credited with having invented gunpowder. Hasan Al-Rammah wrote a treatise, on military science, containing pyrotechnic recipes in which special attention has been paid to the preparation and purification of saltpeter.

Medicine

Medicine is one of the branches of science to which the followers of Islam have made a quite great contribution. Medical literature of Medical Muslims shows that they knew the contagious nature of certain diseases like smallpox and measles. They discovered the capillary system and the circulation of blood.

Al-Kindi wrote more than 20 books on Medicine and made an extraordinary attempt to establish posology (the science of doses) on a mathematical basis. Zakariya Razi knew that the pupil contracts to light, jaundice is caused by obstruction of the bile passages and that disorders of the bladder are accompanied by blood in the urine.

Abu Qasim Al-Zahrawi, a great surgeon and the author of the famous medical Encyclopedia, the Kitab Al-Tasrif described and gave the diagrams of no less than 200 surgical instruments. Ibn Sina was the first to use catheters made of the skins of various animals, and he mentioned intravesical injections by means of a silver syringe. He was the master-mind and considered as the chief authority in medicine for almost seven centuries.

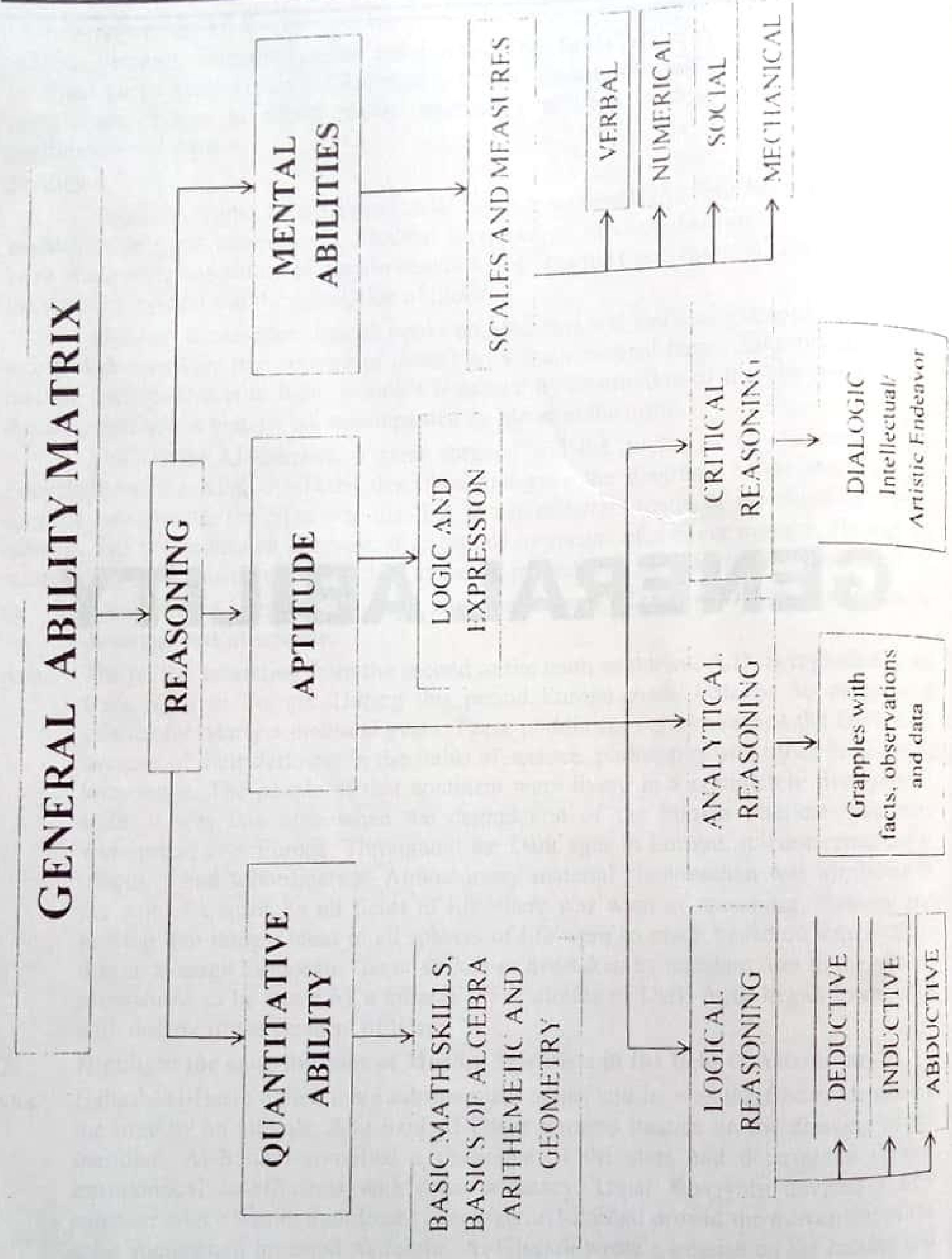
Q. What period is called the Dark Ages in Europe? Explain with reference to the development of science.

Ans. The period extending from the second to the tenth centuries, A.D. is regarded as the Dark Ages in Europe. During this period Europe made little or no progress in science for nearly a thousand years. These middle ages are known as the Dark Ages because of their darkness in the fields of science, philosophy and other branches of knowledge. The people of that continent were living in a completely disorganised state. It was this time when the degradation of the human intellect was most widespread over Europe. Throughout the Dark ages in Europe, science remained in obscurity and subordination. Almost every material phenomenon was attributed to the will of a spirit. In all fields of life, there was want of reasoning, thinking and looking into things. Ideas in all spheres of life were so much based on superstitions that an average European, "fever-striken or overtaken by accident, ran to the nearest saint-shrine to be cured by a miracle". The clouds of Dark Ages began to dissolve with the rise of the crescent of Islam.

Q. Highlight the contributions of Muslim Scientists in the field of Astronomy?

Ans. Habash Al-Hasib edited three astronomical tables and he was the first to determine the time by an altitude. Abu Said Al-Darrir wrote a treatise on the drawing of the meridian. Al-Battani compiled a catalogue of the stars and determined various astronomical co-efficients with great accuracy. Umar Khayyam devised a new calendar which was extraordinarily accurate. Al-Zarqali proved the movement of the solar apogee and invented Astrolabe. Al-Ghazali wrote a treatise on the motion and nature of the stars. Ibn Al-Haitham observed the semi-lunar shape of the image of the sun during eclipses on a wall opposite a fine hole in the window-shutters the first record of the camera obscura. The followers of Islam established astronomical observatories all over the realm of Islam from Spain to India.

GENERAL ABILITY


GENERAL ABILITY MATRIX
REASONING
QUANTITATIVE ABILITY
APTITUDE
MENTAL ABILITIES
BASIC MATH SKILLS, BASICS OF ALGEBRA ARITHEMETIC AND GEOMETRY
LOGIC AND EXPRESSION
SCALES AND MEASURES
VERBAL
NUMERICAL
SOCIAL
MECHANICAL
LOGICAL REASONING
ANALYTICAL REASONING
CRITICAL REASONING
DEDUCTIVE
INDUCTIVE
ABDUCTIVE
Grapples with facts, observations and data
DIALOGIC
Intellectual/ Artistic Endeavor

CHAPTER 6

QUANTITATIVE ABILITY/REASONING

BASIC MATHEMATICAL SKILL (Outline)

ARITHMATIC:

Branch of Mathematics, dealing with real numbers. Sums, Subtractions, Multiplications, Divisions, Squares etc.

ALGEBRA:

Terms, Expressions, Equations.

GEOMETRY:

Visual study of shapes, sizes and patterns.

AVERAGE:

A mathematical tool to simplify a list of numbers into a single number that approximates the value of all of them.

RATIOS:

It is a comparison between two different things ratio compares value.

RATES:

It is a special fixed ratio in which two terms are in different units.

PERCENTAGE:

A part of a whole expressed in hundredths. A sort of proportion.

EQUATION:

An equation is an equality containing one or more variables.

SYMBOLS:

Symbols are used in mathematics to express formula or a Constant. Remainders or Rounding off.

- **Concept Mathematical Skills:**

First of all we must know the basic rules and principles of quantitative section. They must be recorded on a small note book. Formulae should also be memorized.

1. Read the question/problem carefully the whole question. Understand the problem before solving it.

   Examples:

   (i) $6 + 17 + 29 + 24 + 13 + 1$

   You know the $6 + 24$, $17 + 13$, $29 + 1$ is equal to 30 in each case. So the answer is $30 + 30 + 30 = 90$

   (ii) $29 \times 470 \times 121 \times 0$

   The answer is 0 because 0 multiplied by 0 is 0.

2. In multiple choice questions, read all the choices first. Look carefully and narrow your choice.

3. Make sure what is asked and what value has to be found.

   Example: Ali drives his car at 100 km/h from Lahore to Pindi and Akbar drives at 120 km/h from Lahore to Pindi. Who travels a longer distance?

4. Sometimes none of given answers is correct. Judge carefully. Do not reject the answer without estimating.

Basic Mathematical Skills:

Signed numbers are very important:

Examples:

$$7 - 2 = 5$$
$$-7 - 2 = -9$$
$$3 - 9 = -6$$
$$3x - 7x = -4x$$

Number System:

Integers: All positive and negative whole numbers are integers. Zero is also an integer.

$$\ldots\ldots -2,\ -1,\ 0, 1, 2, 3, \ldots\ldots$$

Odd Numbers:

3, 5, 7, 11, ... etc.

If x is an odd number, next odd number is $x + 2$, previous odd number is $x - 2$.

Even Numbers:

Any number which can be divided by 2.

Examples: 2, 4, 6, ...

If x is an even number, next even number is $x + 2$ and the previous number is $x - 2$.

Prime Numbers: A number that can be divided by itself and by 1 only.

Examples: 2, 3, 5, 7, 11, 13......

2 is the only even prime number.

Absolute Value:

The absolute value of a quantity is the quantity with only positive value.

Absolute value of −9 and +9 is written as |−9| and |+9| and is equal to 9.

Addition and Subtraction:

Signs +, − are very important in addition and subtraction.

Examples:

$$3 + 5 = 8 \qquad -3 + (-5) = -8$$

$$2 - 9 = 2 + (-9) = -7$$

$$2x - 7x = -5x$$

$$-3a - 5a - 7a = -15a$$

Multiplication:

If two quantities with the same sign are multiplied the answer is positive and if two quantities have different signs the answer is negative.

Examples:

$$(+6) \times (+7) = +42$$

$$(-3)(-5) = +15$$

$$(-4)(+6) = -24$$

$$(+2)(-3) = -6$$

DIVISION:

Dividing two quantities with the same sign the answer is positive. Dividing two quantities with different signs, the answer is negative.

Examples:

$$\frac{-24}{8} = -3, \quad \frac{24}{8} = 3, \quad \frac{-24}{-8} = 3$$

Order of Operation:

BODMAS

It stands for

B for bracket

O for off. It is multiplication done before division.

D for division

M for Multiplication

A for addition

S for subtraction

Fraction:

Fraction is a part of a whole. It is also a way of expressing division. The expression

$\frac{a}{b}$ is the same as a divided by b. a is called the numerator and b the denominator. $\frac{5}{12}$ can be thought as 5 parts out of 12 parts.

Proper Fraction:

If numerator is smaller than denominator, fraction is said to proper, as $\frac{7}{9}$.

Improper Fraction:

If numerator is bigger than denominator, it is an improper fraction as $\frac{11}{5}$.

Mixed Fraction:

It is a combination of a whole number and a fraction. Like $5\frac{3}{8}$, 5 is a whole number and $\frac{3}{8}$ is the fraction.

ADDING AND SUBTRACTING FRACTION

(i) Same Denominator

Like $\frac{5}{16}+\frac{11}{16}-\frac{9}{16}=\frac{5+11-9}{16}=\frac{7}{16}$

(ii) Different Denominators

Like $\frac{1}{3}+\frac{1}{6}-\frac{1}{4}$; LCM of 3, 6, 4 = 12

Make the denominators equal

$$\frac{1\times 4}{3\times 4}+\frac{1\times 2}{6\times 2}-\frac{1\times 3}{4\times 3}$$

$$=\frac{4}{12}+\frac{2}{12}-\frac{3}{12}$$

$$\frac{4+2-3}{12}=\frac{3}{12}=\frac{1}{4}$$

MULTIPLYING FRACTIONS

To multiply the fractions, just multiply the numerators and denominators.

$$=\frac{\text{Product of Numerators}}{\text{Product of Denominators}}=\frac{a}{b}\times\frac{c}{d}=\frac{a\times c}{b\times d}$$

Or $\frac{2}{5}\times\frac{3}{7}=\frac{6}{35}$

REDUCING FRACTIONS:

A fraction can be reduced to its lowest form by dividing the numerator and denominator by the same number.

$$\frac{48\div 8}{72\div 8}=\frac{6\div 3}{9\div 3}=\frac{2}{3}$$

COMPARING FRACTIONS:

Sometimes we have to find the smaller fraction or bigger fraction or arrange them in order.

(i) If the denominator is the same, then the fraction with a bigger denominator is bigger

$\frac{7}{8},\frac{5}{8},\frac{3}{8}$–. $\frac{7}{8}$ is bigger

(ii) If denominators are different, then make the denominators equal

For example: $\frac{1}{2},\frac{1}{3},\frac{1}{4}$ LCM of 2, 3, 4 = 12

$$\frac{1}{2}=\frac{1\times 6}{2\times 6}=\frac{6}{12}$$

$$\frac{1}{3}=\frac{1\times 4}{3\times 4}=\frac{4}{12}$$

$$\frac{1}{4}=\frac{1\times 3}{4\times 3}=\frac{3}{12}$$

$\frac{6}{12},\frac{4}{12},\frac{3}{12}$, so $\frac{1}{2}$ is bigger.

DECIMALS:

Decimal is also used to show a fraction

Like $\frac{1}{2}=0.5$, $\frac{1}{8}=0.125$, $2\frac{3}{5}=2.6$

SOLVED EXAMPLES

Arrange the fractions in ascending order:

$\frac{1}{3},\frac{1}{2},\frac{1}{5}$ LCM of 3, 2, 5 = 30

Make the denominators equal

$$\frac{1}{3}=\frac{10}{30},\frac{1}{2}=\frac{15}{30},\frac{1}{5}=\frac{6}{30}$$

$$\frac{6}{30}, \frac{10}{30}, \frac{15}{30}$$

So $\frac{1}{5}, \frac{1}{3}, \frac{1}{2}$ are in ascending order.

2. **Reduce the lowest fraction.**

$$\frac{96 \div 8}{144 \div 8} = \frac{12 \div 6}{18 \div 6} = \frac{2}{3}$$

3. **Simplify the fraction.**

$$\frac{2\frac{1}{2}}{4\frac{1}{2} - 2\frac{1}{6}} = \frac{\frac{5}{2}}{\frac{9}{2} - \frac{13}{6}} = \frac{\frac{5}{2}}{\frac{27-13}{6}} = \frac{\frac{5}{2}}{\frac{14}{6}}$$

$$= \frac{5}{2} \div \frac{14}{6} = \frac{5}{2_1} \times \frac{6^3}{14} = \frac{15}{14} = 1\frac{1}{14}$$

4. **In a class of 30 students 20 are boys. What fraction of the class is girls?**

Total students = 30

Boys = 20

Girls = 30 – 20 = 10

$$\text{Fraction} = \frac{\text{Girls}}{\text{Total students}} = \frac{10}{30} = \frac{1}{3}$$

5. **Express $\frac{7}{8}$ as decimal fraction:**

$$\begin{array}{r} 0.875 \\ 8\overline{)\ 7.0} \\ 64 \\ \hline 60 \\ 56 \\ \hline 40 \\ 40 \\ \hline \times \end{array}$$

$\frac{7}{8} = 0.875$

6. **Reduce to lowest fraction:**

$$\frac{84 \div 4}{144 \div 4} = \frac{21 \div 3}{36 \div 3} = \frac{7}{12}$$

7. **Simplify:**

$3 + 3 \div 3 + 3$

= $3 + 1 + 3$ Divide 3 ÷ 3 first

= 7

8. **Simplify:** $\left(\frac{1}{2}-\frac{1}{3}\right)+\frac{1}{6}$

= $\left(\frac{3-2}{6}\right)\div\frac{1}{6}$ [LCM of 2,3 = 6]

= $\frac{1}{6}\div\frac{1}{6}=\frac{1}{6}\times\frac{6}{1} = 1$

QUESTIONS

Select the correct answer:

1. A man earns Rs. x in a week and spends Rs. y. What part of his weekly salary does he save?

(a) $\frac{x}{y}$ (b) $\frac{y}{x}$ (c) $\frac{x+y}{x}$ (d) $\frac{x-y}{y}$

2. Simplify: $2 + 2 \div 2 + 2$

(a) 1 (b) 4 (c) 6 (d) 5

3. Which is the shortest fraction $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{6}$

(a) $\frac{1}{2}$ (b) $\frac{1}{6}$ (c) $\frac{1}{4}$ (d) $\frac{1}{3}$

4. Ali spends $\frac{1}{2}$ of his pocket money on food and $\frac{1}{3}$ of the remaining to buy books. What fraction of this money is left with him?

(a) $\frac{1}{3}$ (b) $\frac{1}{4}$ (c) $\frac{1}{2}$ (d) $\frac{1}{6}$

5. A man played 20 matches at which he won 12. What part of the matches played did he lose?

(a) $\frac{3}{5}$ (b) $\frac{2}{5}$ (c) $\frac{2}{3}$ (d) $\frac{1}{5}$

6. Simplify: $\frac{1}{3}+\frac{1}{3}\div\frac{1}{3}+\frac{1}{3}$

(a) $1\frac{1}{3}$ (b) 1 (c) $1\frac{2}{3}$ (d) $1\frac{1}{2}$

7. Simplify: $\frac{0.5}{0.005}$

(a) 1 (b) 10 (c) 0.05 (d) 100

8. Simplify: $7x - 4x \times 2$

(a) $6x$ (b) $-x$ (c) $5x$ (d) 0

9. Change $\frac{3}{16}$ as decimal fraction:

(a) 0.1875 (b) 0.185 (c) 0.125 (d) 0.375

10. There are x boys and y girls in a class. What fraction of students are the girls?

(a) $\frac{y}{x}$ (b) $\frac{x}{y}$ (c) $\frac{y}{x+y}$ (d) $\frac{x}{x+y}$

ANSWERS

1.	(c)	2.	(d)	3.	(b)	4.	(d)	5.	(b)	6.	(c)	7.	(d)
8.	(b)	9.	(a)	10.	(c)								

AVERAGE

To find the average, add the numbers and divide by the number of numbers.

Examples: Find the average of 7, 2, 9, 11, 6

$$\text{Sum} = 7 + 2 + 9 + 11 + 6 = 35$$

$$\text{Numbers} = 5$$

$$\text{Average} = \frac{35}{5} = 7$$

1. Average of 5 members: 5, 7, x, 9, 3 is 6 find x.

$$\frac{5+7+x+9+3}{5} = 6$$

$$\frac{24+x}{5} = 6$$

$$24 + x = 6 \times 5$$

$$x = 30 - 24 = 6$$

Median:

Write the numbers in ascending or descending order. The middle number is the mean. If there are even numbers, the average of two numbers in the middle is the median.

Example: Find the median of 45, 33, 29, 47, 60

Arrange the numbers in ascending order

29, 33, 45, 47, 60

The middle number is 45. Hence Median is 45

2. Find the median of 4, 7, 11, 9, 6, 12

Arranging the numbers in ascending order:

4, 6, 7, 9, 11, 12

There are even numbers. Two middle numbers are 7 and 9

Average of 7 and 9 = $\frac{7+9}{2} = \frac{16}{2} = 8$

Hence Median is 8.

Mode:

The number which appears most often is the mode of the numbers.

Example: Find the mode of:

2, 5, 3, 7, 3, 9, 3, 8, 7

Arrange the numbers

2, 3, 3, 3, 5, 7, 7, 8, 9

Number 3 occurs most is three times.

Hence Mode is 3.

MCQs ON AVERAGE

Mark (✓) ***against the correct answer in each of the following:***

1. A train is moving with a speed of 180 km/hr. Its speed is:
   (a) 5 m/sec (b) 30 m/sec (c) 40 m/sec (d) 50 m/sec
2. A train travels at 82:6 km/hr. How many metres will it travel in 15 minutes?
   (a) 2065 m (b) 265 m (c) 2650 m (d) 20650 m
3. An athlete runs 200 metres race in 24 seconds. His speed is:
   (a) 20 km/hr (b) 24 km/hr (c) 28.5 km/hr (d) 30 km/hr
4. A man riding his bicycle covers 150 metres in 25 seconds. What is his speed in km per hour?
   (a) 20 km/hr (b) 21.6 km/hr (c) 23 km/hr (d) 25 km/hr
5. In what time can Sonali cover a distance of 400 m, if she runs at a speed of 20 km/hr?
   (a) $1\frac{1}{5}$ minutes (b) $1\frac{1}{2}$ minutes (c) 2 minutes (d) 3 minutes
6. A man completes 30 km of a journey at 6 km/hr and the remaining 40 km of the journey in 5 hours. His average speed for the whole journey is:
   (a) $6\frac{4}{11}$ km/hr (b) 7 km/hr. (c) $7\frac{1}{2}$ km/hr (d) 8 km/hr
7. A man covers half of his journey at 6 km/hr and the remaining half at 3 km/hr. His average speed is:
   (a) 3 km/hr (b) 4 km/hr (c) 4.5 km/hr (d) 9 km/hr
8. A person starting from his house covers a distance at 15 km/hr and returns to the starting place at 10 km/hr. His average speed during whole journey is:

(a) 11 km/hr (b) 12 km/hr (c) $12\frac{1}{2}$ km/hr (d) 13 km/hr

9. The speeds of A and B are in the ratio 3 : 4, A takes 20 minutes more than B to reach a destination. In what time does A reach the destination?

(a) $1\frac{1}{3}$ hours (b) 2 hours (c) $1\frac{2}{3}$ hours (d) $2\frac{2}{3}$ hours

10. A is twice as fast as B and B is thrice as fast as C. The journey covered by C in 42 minutes will be covered by A in

(a) 7 minutes (b) 14 minutes (c) 28 minutes (d) 63 minutes

ANSWERS

1. (d)	2. (d)	3. (d)	4. (b)	5. (a)	6. (b)	7. (b)	8. (b)	9. (a)	10. (a)

SOLUTION

1. $180 \text{ km/hr} = \left(180 \times \frac{5}{18}\right)$ m/s.ec = 50 m/sec.

2. $82.6 \text{ km/hr} = \left(82.6 \times \frac{5}{18}\right) \text{ m/sec} = \frac{413}{18} \text{ m/sec}$

Distance, covered in 15 min = $\left(\frac{413}{18} \times 15 \times 60\right)$ m = 20650 m.

3. Speed = $\frac{200}{24}$ m/sec = $\left(\frac{200}{44} \times \frac{18}{5}\right)$ 1 km/hr = 30 km/hr.

4. Speed = $\frac{150}{25}$ m/sec $\left(\frac{150}{25} \times \frac{18}{5}\right)$ km/hr = $\frac{108}{5}$ km/hr = 21.6 km/hr.

5. $20 \text{ km/hr} = \left(20 \times \frac{5}{18}\right) \text{ m/sec} = \frac{50}{9} \text{ m/sec.}$

Time taken to cover 400 m $\left(400 \times \frac{9}{50}\right)$ sec = 72 sec = $1\frac{12}{60}$ min = $1\frac{1}{5}$ min.

6. Total distance = (30 + 40) km = 70 km.

Total time taken = $\left(\frac{30}{6} + 5\right)$ hrs = 10 hrs.

Average speed = $\frac{70}{10}$ km/hr = 7 km/hr.

7. Average speed = $\frac{2xy}{(x+y)}$ km/hr = $\frac{2 \times 6 \times 3}{(6+3)}$ m/hr = 4 km/hr.

8. Average speed = $\frac{2xy}{(x+y)}$ km/hr = $\frac{2 \times 15 \times 10}{(15+10)}$ km/hr = 12 km/hr.

9. Let the time taken *by A* be *x* hrs.

Then, time taken by B = $\left(x - \frac{20}{60}\right)$ hrs = $\left(x - \frac{1}{3}\right)$ hrs.

Ratio of speeds = Inverse ratio of time taken.

$$3 : 4 = \left(x - \frac{1}{3}\right) : x \Rightarrow \frac{3x-1}{3x} = \frac{3}{4} \Rightarrow 12x - 4 = 9x$$

$$\Rightarrow 3x = 4 \Rightarrow x = \frac{4}{3} \text{ hrs} = 1\frac{1}{3} \text{ hrs.}$$

Required time = $1\frac{1}{3}$ hrs.

10. Let C's speed be *x* metres/min.

Then, B's speed = 3x metres/min and A's speed = 6x metres/min.

Ratio of speeds of A and C = Ratio of times taken by C and A

RATIO

IMPORTANT FACTS AND FORMULAE

1. **Ratio:** The ratio of two quantities *a* and *b* in the same units is a fraction that one quantity is of the other. Thus, $\frac{a}{b} = a : b$.

In *a* : *b*, we call *a* as **antecedent and *b* as consequent.**

Rule: *The multiplication or division of each term of a ratio by the same non-zero number does not affect the ratio.*

Thus, 3 : 5 is the same as 6 : 10 or 9 : 15 or 12 : 20 etc.

2. **Proportion**: *The equality of two ratios is called proportion.*

As 2 ; 3 = 6 : 9, we write, 2 : 3 :: 6 : 9 and we say that 2, 3, 6, 9 are in proportion. Here 2 and 9 are called **extremes** while 3 and 6 are called **means.**

In a proportion, **Product of extremes = Product of means.**

3. *(i)* If *a* : *b* :: *c* : *d*, then *d* is called the **fourth proportional** to a, b, c.

(ii) If a : *b* :: *b* : c, then c is called the **third proportional** to a, *b*.

(iii) **Mean proportional** between *a* and *b* = $\sqrt{ab}$

SOLVED EXAMPLES

Ex. 1 If a : b = 2 : 3 and b : c = 5 : 7, find (i) a : c (ii) a : b : c.

Sol. (i) We have $\frac{a}{b} = \frac{2}{3}$ and $\frac{b}{c} = \frac{5}{7}$

[redacted]

$$\therefore \quad \frac{a}{c} = \left(\frac{a}{b} \times \frac{b}{c}\right) = \left(\frac{2}{3} \times \frac{5}{7}\right) = \frac{10}{21}.$$

$\therefore$ a : c = 10 : 21

(ii) $\frac{a}{b} = \frac{2}{3}$ and $\frac{b}{c} = 5 : 7 = \frac{3}{5} \times 5 : \frac{3}{5} \times 7 = 3 : \frac{21}{5}$.

$\therefore$ a : b = 2 : 3 and b : c = 3 : $\frac{21}{5}$

$\therefore$ a : b : c = 2 : 3 : $\frac{21}{5}$ = 10 : 15 : 21

Ex. 2 If $\frac{a}{8} = \frac{b}{9} = \frac{c}{12}$, find a : b : c.

Sol. Let $\frac{a}{8} = \frac{b}{9} = \frac{c}{12}$ = k. Then, a = 8k, b = 9k and c = 12k.

$\therefore$ a : b : c = 8k : 9k = k : 12k = 8 : 9 : 12.

Hence a : b : c = 8 : 9 : 12.

Ex. 3. If (5x + 3y) : (5x − 3y) = 3 : 1, then x : y = ?

Sol. $\frac{5x + 3y}{5x - 3y} = \frac{3}{1} \Rightarrow 5x + 3y = 15x - 9y \Rightarrow 10x = 12y \Rightarrow \frac{x}{y} = \frac{12}{10} = \frac{6}{5}$

$\therefore$ x : y = 6 : 5.

Ex. 4. Find the third proportional to 9 and 12.

Sol. Third proportional to 9 and 12 is equal to fourth proportional to 9, 12, 12.

Let it be x. then,

$9 : 12 :: 12\ x \Rightarrow 9x \times 12 \Rightarrow = \frac{12 \times 12}{9} = 16.$

$\therefore$ Third proportional to 9 and 12 is 16.

Ex. 5. ***A bag contains one-rupee, 50-p and 25-p coins in the ratio 8:9:11. If the total money in the bag is Rs 122, find the number of coins of each type.***

Sol. Let the number of one-rupee, 50-p and 25-p coins be *8x*, *9x* and 11x respectively. Then,

$8x + \frac{9x}{2} + \frac{11x}{4} = 122 \Rightarrow 32x + 18x + 11x = 488 \Rightarrow 61x = 488 \Rightarrow x = 8.$

Number of one-rupee coins = (8 x 8) = 64.

Number of 50-p coins = (9 × 8) = 72.

Number of 25-p coins = (1 i × 8) = 88.

Ex. 6. *In a college, the number of students studying Arts, Commerce and Science are in the ratio of 4 : 7 : 9. If the number of students in Arts, Commerce and Science be increased by 30%, 20% and 40% respectively, what will be the new ratio?*

Sol. Let the number of students in Arts, Commerce and Science be 4x, 7x and 9x respectively. Now, they are 130% of 4x, 120% of 7x and 140% of 9x.

$$\text{Required ratio} = \left(\frac{130}{100}\times 4x\right):\left(\frac{120}{100}\times 7x\right):\left(\frac{140}{100}\times 9x\right)$$

$$= \frac{26x}{5}:\frac{42x}{5}:\frac{63x}{5} = 26 : 42 : 63.$$

MCQs ON RATIO

1. The ratio between two numbers is 3 : 4. If each number is increased by 6, the ratio becomes 4:5. The difference between the numbers is:

(a) 1 (b) 3 (c) 6 (d) 8

2. The ratio of boys and girls in a school is 3 : 2. When 6 more girls join, this ratio becomes 6: 5. How many boys are there in the school?

(a) 24 (b) 30 (c) 42
(d) Cannot be determined (e) None of these

3. In a school, the ratio of boys and girls is 4:5. When 100 girls leave the school, the ratio becomes 6:7. How many boys are there in the school?

(a) 1300 (b) 1500 (c) 1600
(d) Cannot be determined (e) None of these

4. On dividing a sum of Rs. 832 between A and B in the ratio $\frac{1}{3}:\frac{1}{5}$, their shares are:

(a) Rs. 520, Rs. 312 (b) Rs. 500, Rs. 332 (c) Rs. 530, Rs. 302 (d) Rs. 490, Rs. 342

5. Rs. 6400 are divided among three workers in the ratio $\frac{3}{5}:2:\frac{5}{3}$. The share of the second worker is:

(a) Rs. 2560 (b) Rs. 3000 (c) Rs.3200 (d) Rs. 3840

6. Instead of dividing Rs 117 among P, Q, R in the ratio $\frac{1}{2}:\frac{1}{3}:\frac{1}{4}$, by mistake it was divided in the ratio 2 : 3 :4. Who gained in the transaction?

(a) Only P (b) Only Q (c) Only R (d) Both Q and R

7. The ratio of the number of students studying in schools A, B and C is 5:6:8, If the number of students in each of the schools is increased by 30%, 25% and 25% respectively, what will be the new ratio of the students in schools *A*, B and C?

(a) 14:15:20 (b) 13 : 15 : 20 (c) 13:14:15
(d) 15 : 17 : 19 (e) None of these

8. The ratio of earnings of A and B is 8 : 9. If the earnings of A increase by 50% and the earnings of B decrease by 25%, the new ratio of their earnings is 16:9. What are A's earnings?

(a) Rs. 22000 (b) Rs. 28500 (c) Rs. 37000
(d) Cannot be determined (e) None of these

9. The monthly incomes of A and B are in the ratio 2:3 and their monthly expenses are in the ratio 5 : 9. If each of them saves Rs 600 per month, then their monthly incomes are:

(a) Rs. 1500, Rs 2250 (b) Rs 1200, Rs 1800
(c) Rs 1600, Rs 2400 (d) Rs. 1400, Rs 2100

10. If 32 students in a class are females and the ratio of female to male students is 16 : 9, then what percentage of the class is female?

(a) 32% (b) 36% (c) 56.25% (d) 64% (e) 72%

ANSWERS

1. (c)	2. (e)	3. (e)	4. (a)	5. (b)	6. (d)	7. (b)	8. (d)	9. (c)	10. (d)

SOLUTION

1. Let the numbers be $3x$ and $4x$. Then,

$$\frac{3x+6}{4x+6} = \frac{4}{5} \Rightarrow 5\,(3x+6) = 4\,(4x = 6) \Rightarrow (30 - 24) = 6.$$

Difference between the numbers = $(4x - 3x) = x = 6$.

2. Let the number of boys and girls be 3x and 2x respectively.

$$\text{Then, } \frac{3x}{(2x+6)} = \frac{6}{5} \Rightarrow 15x = 12x + 36 \Rightarrow 3x = 36 \Rightarrow x = 12.$$

Number of boys = $(3 \times 12) = 36$.

3. Let the number of boys and girls be 4x and 5x respectively.

$$\text{Then, } \frac{4x}{5x-100} = \frac{6}{7} \Rightarrow 28x = 30x - 600 \Rightarrow 2x = 600 \Rightarrow x = 300.$$

Number of boys = $(4 \times 300) = 1200$.

4. Given ratio = $\frac{1}{3}:\frac{1}{5} = 5 : 3$.

$$\text{1st part} = \text{Rs.} \left(832 \times \frac{5}{8}\right) = \text{Rs. } 520;\ \text{2nd part} = \text{Rs.} \left(832 \times \frac{3}{8}\right) = \text{Rs. } 312.$$

5. Given ratio = $\frac{3}{5}:\frac{2}{1}:\frac{5}{3}$ f= 9 9 : 30 : 25.

Share of the second worker = Rs. $\left(6400\times\frac{30}{64}\right)$ = Rs 3000.

6. $\frac{1}{2}:\frac{1}{3}:\frac{1}{4} = 6:4:3$. Then,

P = Rs. $\left(117\times\frac{6}{13}\right)$ = Rs. 54, Q = Rs. $\left(117\times\frac{4}{13}\right)$ = Rs. 36 and R = Rs $\left(117\times\frac{3}{13}\right)$ = Rs. 27.

Again, the ratio is 2 : 3 : 4.

P = Rs $\left(117\times\frac{2}{9}\right)$ = Rs. 26, Q = Rs $\left(117\times\frac{3}{9}\right)$ = Rs. 39 and

R = Rs. $\left(117\times\frac{4}{9}\right)$ = Rs.52.

Thus, both Q and R gained in the transaction.

7. Let the number of students in A, B, C be 5x, 6x and 8x respectively.

New strength = (130% of 5x), (125% of 6x) and (125% of 8x)

$\left(\frac{130}{100}\times 5x\right), \left(\frac{125}{100}\times 6x\right), \left(\frac{125}{100}\times 8x\right)$

New ratio = $\frac{650x}{100}:\frac{750x}{100}:\frac{1000x}{100}$ = 65 ; 75 : 100 = 13 : 15 : 20.

8. Let the earnings of A and B be Rs. 8x and Rs. 9x respectively.

New earnings of A and B = Rs. (150% of 8x), Rs. (75%, of 9x)

= Rs. $\left(\frac{150}{100}\times 8x\right)$, = Rs. $\left(\frac{75}{100}\times 9x\right)$, = Rs. 12x, $\frac{27x}{4}$,

Ratio of new earnings = 12x : $\frac{27x}{4}$ = 48 : 27 = 16 : 9.

Thus, we cannot find A's earnings.

9. Let the incomes of A and B be Rs *2x* and Rs *3x* respectively and their expenditure be Rs 5y and Rs 9y respectively. Then,

2x – 5y = 600 ...(i) and 3x – 9y = 600 ⇒ x – 3y = 200 .... (ii)

On solving (i) and (ii), we get x = 800.

So, their incomes are Rs 1600 and Rs 2400 respectively.

10. Let the females be 16x and males 9x.

Then, 16x = 32 ⇒ x = 2.

So, there are 32 females and 18 males in the class.

Percentage of females = $\left(\frac{32}{50}\times 100\right)\%$ = 64%

PERCENTAGE

IMPORTANT FACTS AND FORMULAE

1. By a certain percent, we mean that many hundredths.

$$x \text{ per cent} = x\% = \frac{x}{100}$$

thus, $25\% = \frac{25}{100} = \frac{1}{4}, 0.3 = \frac{3}{10} = \left(\frac{3}{10} \times 100\right)\% = 30\%$

2. (i) If A is R% more than B, then B is less than A by

$$\left\{\frac{R}{(100+R)} \times 100\right\}\%$$

(ii) If A is R% less than B, then B is less than A by

$$\left\{\frac{R}{(100-R)} \times 100\right\}\%$$

3. **RESULTS ON POPULATION**

Let P be the population of a town now. Let it increase at R% per annum. Then,

(i) Population after *n* years $= P \times \left(1+\frac{R}{100}\right)^n$

(ii) Population *n* years ago $= \frac{P}{\left(1+\frac{R}{100}\right)^n}$

4. **RESULTS ON DEPRECIATION:**

Let the present value of a machine be Rs P and let it depreciate at R% per annum. Then,

(i) Value of the machine after *n* years = Rs. $\left\{P\left(1-\frac{R}{100}\right)^n\right\}$.

(ii) Value of the machine *n* years ago = Rs. $\left\{\frac{P}{\left(1-\frac{R}{100}\right)^n}\right\}$

5. (i) If the price of a commodity increases by R%, then reduction in consumption so as not to increase the expenditure is given by

Reduction % = $\left\{\frac{R}{100+R}\times 100\right\}\%$.

(ii) If the price of 9 commodity decreases by R%, then m order to have no change in expenditure, we have

Increase % in consumption = $\left\{\frac{R}{100-R}\times 100\right\}\%$.

SOLVED EXAMPLES

Ex. 1. *Express each of the following as a fraction:*

(i) 32% (b) 260% (iii) 0.8%

Sol. We have

(i) $32\% = \frac{32}{100} = \frac{8}{25}$ (ii) $160\% = \frac{160}{100} = \frac{8}{5} = 1\frac{3}{5}$ (iii) $0.8\% = \frac{0.8}{100} = 0.008$.

Ex. 2. *Express each of the following as a decimal:*

(i) 18% (ii) 5% (iii) 126% (iv) 0.06%

Sol. **We have**

(i) $18\% = \frac{18}{100} = 0.18$ (ii)$5\% = \frac{5}{100} = 0.05$

(iii) $126\% = \frac{126}{100} = 1.26$ (iv)$0.06\% = \frac{0.06}{100} = 0.0006$.

Ex. 3. *Express* $\frac{3}{4}$ *as rate per cent.*

Sol. $\frac{3}{4} = \left(\frac{3}{4}\times 100\right)\% = 75\%$

Ex. 4. ***Evaluate : 45% of 280% of 450.***

Sol. 45% of 280 + 28% of 450 $= \left(\frac{45}{100}\times 280\right) + \left(\frac{28}{100}\times 450\right)$

$= (126 + 126) = 252$

Ex. 5. ***Which is largest in*** $16\frac{2}{3}\%$, $\frac{2}{15}$ ***and 0.181***

Sol. We have

$16\frac{2}{3}\% = \frac{50}{3\times 100} = \frac{1}{6} = 0166$, $\frac{2}{15} = 0.133$ and 3rd number = 0.18.

Clearly, 0.18 is largest.

Ex. 6. ***65% of a number is 21 less than 4/5th of that number. Find the number.***

Sol. Let the number be *x*. Then,

$$\left(\frac{4}{5}x\right) - (65\%\text{ of }x) = \Rightarrow \frac{4x}{5} - \frac{65x}{100} = 21 \Rightarrow \frac{4x}{5} - \frac{13x}{20} = 21$$

$$\Rightarrow 16x - 13x = 420 \Rightarrow 3x = 420 \Rightarrow x = 140.$$

Required number = 140.

Ex. 7. *(i)* ***What per cent is 120 of 90?***

(ii) ***What per cent is 5 gms of 1 kg?***

(iii) ***What per cent is 150 ml of 3-5 litres?***

Sol. (i) Required % = $\left(\frac{120}{90}\times 100\right)\% = \frac{400}{3}\% = 133\frac{1}{3}\%$

(ii) Required % = $\left(\frac{5}{1000}\times 100\right)\% = \frac{1}{2}\% = 0.5\%$

(iii) Required % = $\left(\frac{150}{3500}\times 100\right)\% = \frac{30}{7}\% = 4\frac{2}{7}\%$

Ex. 8. ***If A's salary is 20% more than that of B, then how many per cent is B's salary less than that of A?***

Sol. **(Short cut method)**

B's salary is less than that of A by $\left\{\frac{R}{100+R}\times 100\right\}$

$$= \left(\frac{20}{120}\times 100\right)\% = \frac{50}{3}\% = 16\frac{2}{3}\%$$

Ex. 9. ***If A's salary is 25% less than that of B, then how many per cent is B's salary more than that of A?***

Sol. **(Short cut method)**

B's salary is more than that of A by $\left\{\frac{R}{100-R}\times 100\right\}\%$

$$= \left\{\frac{25}{100-25}\times 100\right\}\% = \left(\frac{25}{75}\times 100\right) = 33\frac{1}{3}\%$$

Ex. 10. ***If the price of tea is increased by 20%, by how much per cent must the consumption of tea be diminished so as not to increase the expenditure?***

Sol. **(Short cut method)**

Reduction % in consumption = $\left\{\frac{R}{100+R}\times 100\right\}\% = \left(\frac{20}{120}\times 100\right)\%$

$$= \frac{50}{3}\% = 16\frac{2}{3}\%$$

EXERCISE

1. **What is 25% of 25% equal to?**
(a) 6.25 (b) 0.625 (c) 0.0625 (d) 0.00625

2. **What percent of 7.2 kg is 18 gms?**
(a) 0.025% (b) 0.25% (c) 2.5% (d) 25%

3. **If 31% of a number is 46.5, then the number is:**
(a) 150 (b) 155 (c) 160 (d) 165

4. **Which number is 60% less than 80 ?**
(a) 48 (b) 42 (c) 32 (d) 12

5. **A number exceeds 20% of itself by 40. The number is**
(a) 50 (b) 60 (c) 80 (d) 320

6. **What percent is 3% of 5% ?**
(a) 15% (b) 1.5% (c) 0.15% (d) None of these

7. **If $37\frac{1}{2}\%$ of a number is 900, then $62\frac{1}{2}\%$ of the number is:**
(a) 1200 (b) 1350 (c) 1500 (d) 540

8. **x% of y is y% of?**
(a) x (b) 100x (c) $\frac{x}{100}$ (d) $\frac{y}{100}$

9. **By how much is 30% of 80 greater than $\frac{4}{5}$th of 25?**
(a) 2 (b) 4 (c) 10 (d) 15

10. **One-third of 1206 is what percent of 134?**
(a) 3 (6) 30 (c) 300 (d) None of these

ANSWERS

1.	(c)	2.	(b)	3.	(a)	4.	(c)	5.	(a)	6.	(d)	7.	(c)
8.	(a)	9.	(b)	10.	(c)								

SOLUTION

1. $25\% \text{ of } 25\% = \frac{25}{100} \times \frac{25}{100} = \frac{625}{1000} = 0.625.$

2. Let x% of 7.2 kg = 18 gms. Then,

$$\frac{x}{100} \times 7.2 \times 1000 = 18 \Rightarrow 72x = 18 \Rightarrow x = \frac{1}{4} = 0.25$$

∴ 0.25% of 7.2kg = 18 gms.

3. Let 31% of $x = 48.5$, Then, $\frac{31}{100} \times x = 46.5$

Hence, the number is 150.

4. Required number = $(80 - 60\%\text{ of }80) = \left(80 - \frac{60}{100} \times 80\right) = (80 - 48) = 32.$

5. $(x - 20\%\text{ of } x) =. \left(x - \frac{20}{100} \times x\right) = \left(x - \frac{x}{5}\right) = \frac{4x}{5}.$

$\therefore \quad \frac{4x}{5} = 40 \Rightarrow x = \left(40 \times \frac{5}{4}\right) = 50.$

6. Required percent = $\left\{\frac{\left(\frac{3}{100}\right)}{\left(\frac{5}{100}\right)} \times 100\right\}\% \left(\frac{3}{5} \times 100\right)\% = 60\%.$

7. Let $37\frac{1}{2}\%$ of $x = 900$. Then, $\frac{75x}{2 \times 100} = 900$

8. Let x% of y = y% of z. Then, $\frac{x}{100} \times y = \frac{y}{100} \times z \Rightarrow z = x.$

x% of y = y% of x.

9. 30% of 80 = $\left(\frac{30}{100} \times 80\right) = 24$, $\left(\frac{4}{5}\text{th of } 25\right) = \left(\frac{4}{5} \times 25\right) = 20$

$\therefore$ Difference = $(24 - 20) = 4.$

10. Let $\frac{1}{3} \times 1206 = x\%$ of 134. Then, $\frac{x}{100} \times 134 = 402.$

$\therefore \quad x = \left(402 \times \frac{100}{134}\right) = 300$

RATE

Definition of Rate

Rate is a ratio that compares two quantities of different units.

In mathematics, a **rate** is the ratio between two related quantities. Often it is a *rate of change*. If the unit or quantity in respect of which something is changing is not specified, usually the rate is *per unit of time*. However, a rate of change can be specified per unit of time, or per unit of length or mass or another quantity. The most common type of rate is "per unit of time", such as speed, heart rate and flux. Ratios that have a non-time denominator include exchange rates, literacy rates and electric field (in volts/meter). In describing the units of a rate, the word "per" is used to separate the units of the two measurements used to calculate the rate (for example a heart rate is expressed "beats per minute"). A rate defined using two numbers of the same units (such as tax rates) or counts (such as literacy rate) will result in a dimensionless quantity, which can be expressed as a percentage (for example, the global literacy rate in 1998 was 80%) or fraction or as a multiple. Often *rate* is a synonym of rhythm or frequency, a count per second (i.e., Hertz); e.g., radio frequencies or heart rate or sample rate.

More about Rate

Unit Rate: Unit rate is a rate in which the second term is 1. For example, Jake types 10 words in 5 seconds. Jake's unit rate is the number of words he can in a second. His unit rate is 2 words per second.

Difference between Rate and Ratio

20 oz of juice for $4, miles per hour, cost per pound etc. are examples of rate. The ratio is the relationship of two numbers. For example you have 2 flashlights and 5 batteries. To compare the ratio between the flashlights and the batteries we divide the set of flashlights with the set of batteries.

The ratio is 2 to 5 or 2:5 or 2/5. All these describe the ratio in different forms of fractions. The ratio can consequently be expressed as fractions or as a decimal. 2:5 in decimals is 0.4.

A rate is a little bit different than the ratio, it is a special ratio. It is a comparison of measurements that have different units, like cents and grams. A **unit rate** is a rate with a denominator of 1.

Example:

Sarah is buying jellybeans for her best friend's birthday party. She buys a bag of 10 lb of jellybeans that costs $45. Sarah is wondering how much 1 lb of jellybeans cost.

$$\$45 = 4500 \text{ cents}$$

$$\frac{4500\text{ cents}}{10\text{lb}} = \frac{450\text{ cents} \div 10}{10\text{lb} \div 10} = \frac{450\text{cents}}{1\text{lb}}$$

$$1 \text{ lb} = 450 \text{ cents} = \$4.50$$

Solved Example on Unit Rate

Q. William can pack 60 toys in 4 hours. Find the unit rate with which he packs toys.

(a) 16 toys/hour
(b) 15 toys/hour
(c) 14 toys/hour
(d) 13 toys/hour

Ans. (b)

Solution:

Step 1: Unit rate is a ratio of different units of measurement with the second term being equal to 1.

Step 2: So, Unit Rate = toys/hours = $\frac{60}{40}$

Step 3: $= \dfrac{60 \div 4}{4 \div 4}$ [Divide both the numerator and the denominator by the denominator.]

Step 4: $= \dfrac{15}{1} = 15$ [Simplify.]

Step 5: So, William can pack 15 toys/hour.

TIME AND DISTANCE

IMPORTANT FACTS AND FORMULAE

1. (i) $\dfrac{\text{Distance}}{\text{Speed}}$ (ii) $\dfrac{\text{Distance}}{\text{Speed}}$ (iii) (Speed) × (Time)

2. (i) $x \text{ km/hr.} = \left(x \times \dfrac{5}{18}\right) \text{ m/sec}$ (ii) $x \text{ m/sec} = \left(x \times \dfrac{18}{5}\right) \text{ km/hr.}$

3. Suppose a man covers a distance at x km/hr and an equal distance at y km/hr.

   Then, average speed during whole journey $= \dfrac{2xy}{(x+y)}$ km/hr.

4. If the ratio of speeds of A and B is $a : b$, then the ratio of times taken by them to cover the same distance is $\dfrac{1}{a} : \dfrac{1}{b}$.

SOLVED EXAMPLES

Q. 1. Convert 54 km/hr into metres/sec.

Sol. $54 \text{ km/hr} = \left(54 \times \dfrac{5}{18}\right) \text{ m/sec} = 15 \text{ m/sec.}$

Q. 2. Convert 16 m/sec into km/hr.

Sol. $16 \text{ m/sec} = \left(16 \times \dfrac{18}{5}\right) \text{ km/hr} = \dfrac{288}{5} \text{ km/hr} = 57.6 \text{ km/hr.}$

Q. 3. Anita can cover a certain distance in 1 hr 24 min by covering two-third of the distance at 4 km/hr and the rest at 5 km/hr. Find the total distance.

Sol. Let the total distance be x km. Then,

$$\frac{\frac{2}{3}x}{4} + \frac{\frac{1}{3}x}{5} = \frac{7}{5} \Rightarrow \frac{x}{6} + \frac{x}{15} = \frac{7}{5} \Rightarrow 5x + 2x = 42 \Rightarrow 7x = 42 \Rightarrow x = 6.$$

$\therefore$ Total distance = 6 km.

Q.4. A man walks from his house to the railway station. If he walks at 5 km/hr, he misses a train by 7 minutes. However, if he walks at 6 km/hr, he reaches the

station 5 minutes before the departure of the train. Find the distance covered by him to reach the station.

Sol. Let the required distance be x km; Then,

$\frac{x}{5} - \frac{x}{6} = \frac{12}{60}$ [Difference between two time intervals is 12 min]

$\Rightarrow \frac{x}{5} - \frac{x}{6} = \frac{1}{5} \Rightarrow 6x - 5x - 6 \quad \Rightarrow x = 6.$

Required distance = 6 km.

Q.5. **Walking at $\frac{7}{8}$ of its usual speed, a train is 10 minutes too late. Find its usual time to cover the journey.**

Sol. New speed = $\frac{7}{8}$ of its usual speed.

New time taken = $\frac{8}{7}$ of the usual time.

$\left(\frac{8}{7}\text{of the usual time}\right) - (\text{usual time}) = 10 \text{ min}$

$\Rightarrow \quad \frac{1}{7}$ of the usual time = 10 min

$\Rightarrow$ Usual time = 70 min.

Q. 6. **A man covers a certain distance by car driving at 70 km/hr and returns back to the starting point riding on a scooter at 55 km/hr. Find his average speed for the whole journey.**

Sol. Average speed $= \frac{2xy}{(x+y)}$ km/hr $= \frac{(2\times 70\times 55}{70+55}$ km/hr

$= \frac{(2\times 70\times 55}{125}$ km/hr $= \frac{308}{5}$ km/hr = 61.6 km/hr.

Q. 7. **The distance between two stations A and B is 450 km. A train starts at 4 P.M. from A and moves towards B at an average speed of 60 km/hr. Another train starts from B at 3:20 P.M. and moves towards A at an average speed of 80 km/hr. How far from A will the two trains meet and at what time?**

Sol. Suppose two trains meet at x km from A.

[Time taken by B to cover (450 − x) km]

− [Time taken by A to cover x km] = $\frac{40}{60}$

$\Rightarrow \quad \frac{450-x}{80} - \frac{x}{60} = \frac{40}{60} \quad \Rightarrow \; 3(450-x) - 4x = 160$

$$\Rightarrow\ 7x = 1190\ \Rightarrow x = 170.$$

Thus the two trains meet at a distance of 170 km from A.

Time taken by A to cover 170 km = $\frac{170}{60}$ hrs = 2 hrs 50 min.

So, the two trains meet at 6:50 PM.

Q. 8. **A man cycles from A to B a distance of 21 km in 1 hr. 40 min. The road from A is level for 13 km and then it is uphill to B. The man's average speed on level is 15 km/hr. Find his average uphill speed.**

Sol. Let the average uphill speed be x km/hr. Then,

$$\frac{13}{15}+\frac{8}{x}=\frac{5}{3}\ \Rightarrow \frac{8}{5}=\left(\frac{5}{3}-\frac{13}{15}\right)=\frac{12}{15}=\frac{4}{5}\quad \Rightarrow x=\frac{(8\times 5)}{4}=10$$

Average uphill speed = 10 km/hr

TWO – STEP RATE PROBLEMS: Asking for more!

1. Four gallons of gasoline cost \$16.80.

   (a) What is the price per gallon?

   \$16.80 / 4 gallons = \$4.20 per gallon

   (b) What is the price of gasoline in terms of gallons per dollar?

   4 gallons /\$16.80 = $\frac{5}{21}$ ~0.24 gallons per dollar

   (c) Do we need both rates? In real life, when will they become useful.

   Yes. Both rates can be useful.

   (1) \$4.20 /gallon is useful when you know how much gasoline you need and want to find out how much it cost.

   (2) 0.24 gallon/dollar is useful when you know how much money you have and want to find out how many gallons of gasoline you can buy with that amount of money.

2. Ashley needs to ride her bike to her friend's house 96 miles away. She is riding at an average rate of 15 miles per hour. She has 6 hours to get there. Will she make it?

   96 miles / 15 miles per hour 6.4 hours. She will not make it in 6 hours.

3. Ed drives from Jefferson to Holden, a distance of 250 miles. He then travels on to Paxton, which is 50 miles from Holden. If it takes him 5 hours to complete the entire trip, how fast is he traveling if he is traveling at a constant speed?

   250 miles + 50 miles = 300 miles
   300 miles / 5 hours = 60 miles per hour

4. Which is the best buy?

   6 shirts for \$25.50 4 shirts for \$18.00 5 shirts for \$21

   \$25.50 / 6 shirts = \$4.25 per shirt
   \$18.00 / 4 shirts = \$4.50 per shirt
   \$21.00 / 5 shirts = \$4.20 per shirt – this is the best buy

5. Lauren took 12 hours to read a 360 page book. At this rate, how long will it take her to read a 400 page book?

360 pages / 12 hours = 30 pages per hour 400 pages / 30 pages per hour = $13\frac{1}{3}$ hours = 13 hours and 20 minutes

6. Pat wants to enter a typing contest. In order to enter, one has to be able to type 50 words per minute. Pat took 15 seconds to type 10 words. Can he enter the contest?

10 words → 15 seconds	**Multiply both by 4 to reach 60 sec, then convert to**
words → 1 minute	**min 40 Pat cannot enter the contest**

Differentiated Rate Problems:

7. Five lemons cost $1.80.

(a) What is the cost per lemon?

$1.80/Siemens = $0.36

(b) At this rate, what is the cost of 9 lemons?

$0.36 × 9 lemons = $3.24

8. David hikes $2\frac{1}{4}$ miles in $\frac{1}{2}$ an hour.

(a) What is his rate in miles per hour?

$2\frac{1}{4}$ miles = $\frac{1}{2}$ an hour	**Multiply both sides by 2 to convert to hours**
$4\frac{1}{2}$ miles = 1 hour	**David hikes $4\frac{1}{2}$ miles per hour.**

(b) At this rate, how long will it take him to walk 18 miles?

18 miles / 4.5 miles per hour = 4 hours

(c) If he walks for 7 hours, how far will he have gone?

4.5 miles per hour × 7 hours = 31.5 miles

9. Erica baby-sits for $4\frac{1}{2}$ hours and is paid $27.

(a) How much does she make per hour?

$27 / 4.5 hours = $6 per hour

(b) How much does she make for 8 hours?

$6 per hour × 8 hours = $48

(c) If the people she baby-sits for have $34 to pay her, how long can they stay out?

$34 / $6 per hour = $5\frac{2}{3}$ hours = 5 hours and 40 minutes

10 Michael is headed to his aunt's house. For the first 2 hours he drives at 55 mph. For next hour, he drives 70 mph. For the final 2 hours he drives 50 mph.

(a) How far does he travel?

55 miles per hour × 2 hours = 110 miles
70 miles per hour × 1 hour = 70 miles
50 miles per hour × 2 hours = 100 miles
110 miles + 70 miles + 100 miles = 280 miles

(b) What is his average speed for the entire trip?

2 hours + 1 hour + 2 hours = 5 hours

280 miles / 5 hours = 56 miles per hour

(c) If he drives the entire trip at 70 mph, how much less time will it take?

280 miles / 70 miles per hour = 4 hours

5 hours = 4 hours = 1 hour less

GEOMETRY

Introduction: It is that branch of Mathematics which deals with the visual study of shapes, sizes, patterns and positions,

Terms used: Points, Lines, Rays, Lin Segments. Planes, intersecting lines

Angles: An angle measures the Turn

Kinds of Angles

Single Angles	**Double Angles**
Acute	Complementary Angles
Right	Supplementary Angles
Obtuse	Adjacent angles on a line
Straight	Vertically Opposite angles
Reflex	Alternative Angles
Full rotation	Corresponding Angles
	Interior Angles

Triangles:

A triangle is a polygon with three edges and three vertices.

KINDS OF TRIANGLES

Right Angled Equilateral

Isosceles

Scalene

Acute angles

Obtuse Angles

Trigonometry: **Trigonometric Ratios**

BASICS OF GEOMETRY

What is Geometry?

Geometry is the visual study of shapes, sizes, patterns, and positions. It occurred in all cultures, through at least one of these five strands of human activities:

ANGLES:

An angle measures the amount of turn

Names of Angles

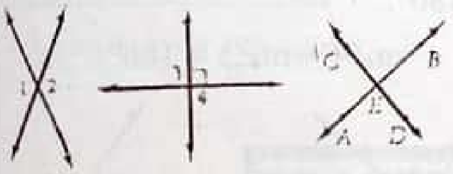
As the Angle Increases, the Name Changes

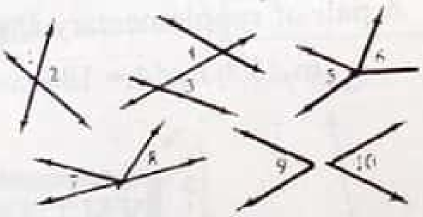
Type of Angle	Description
Acute Angle	an angle that is less than 90°
Right Angle	an angle that is 90° exactly
Obtuse Angle	an angle that is greater than 90° but less than 180°
Straight Angle	an angle that is 180° exactly
Reflex Angle	an angle that is greater than 180°

KINDS OF ANGLES:

Pair of Vertical Angles

Vertical angles are angles formed by two intersecting lines; they share a common vertex but not a common side.





Pairs of vertical angles:

∠1 and ∠2

∠3 and ∠4

∠ABCD and ∠BECAUSE

∠AEC and ∠DEB

Not pairs of vertical angles:

∠1 and ∠2

∠3 and ∠4

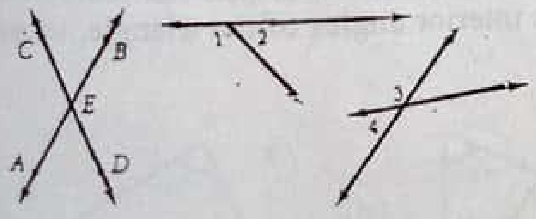
∠5 and ∠6

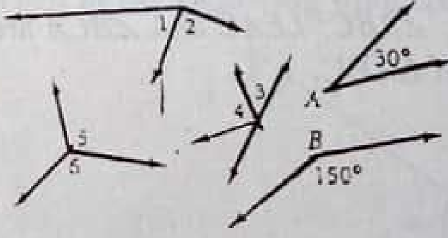
∠7 and ∠8

∠9 and ∠10

Linear Pair of Angles:

Two angles are a linear pair if they share a vertex and a common side and their non-common sides form a line.





Linear pairs of angles:

∠1 and ∠2

∠3 and ∠4

∠AED and ∠AEC

∠BED and ∠DEA

Not linear pairs of angles:

∠1 and ∠2

∠3 and ∠4

∠5 and ∠6

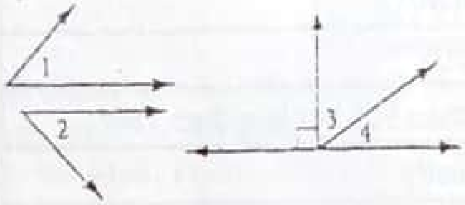
∠A and ∠B

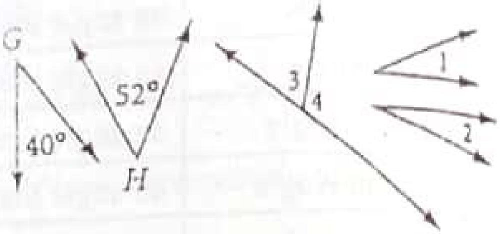
Pair of Complementary Angles

A pair of complementary angles has a sum of 90°

$m\angle 1 + m\angle 2 = 90^\circ$

$m\angle 1 + m\angle 2 \neq 90^\circ$





Pairs of complementary angles:

∠1 and ∠2

∠3 and ∠4

Not pairs of complementary angles:

∠G and ∠H ∠1 and ∠2

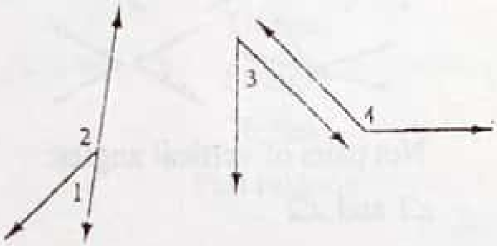
∠3 and ∠4

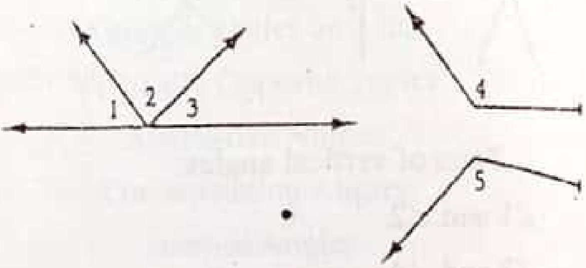
Pair of Supplementary Angles

A pair of supplementary angles has a sum of 180°.

$m\angle 3 + m\angle 4 .= 180$

$m\angle 4 + m\angle 5 > 180^\circ.$





Pairs of supplementary angles:

Not pairs of supplementary angles

TRIANGLES

A plane figure formed by having three straight edges as its sides is called a triangle.

Figure 1 shows a triangle *ABC*, which can be denoted by Δ*ABC*, formed by the three sides *AB*, *EC* and *CA*. The points *A*, *B* and *C* are called the vertices (singular: vertex) of the triangle. ∠*ABC*; *LEAC* and ∠*BCA* are called the interior angles of the triangle, or simply the angles of ΔABC.

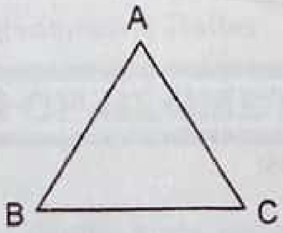
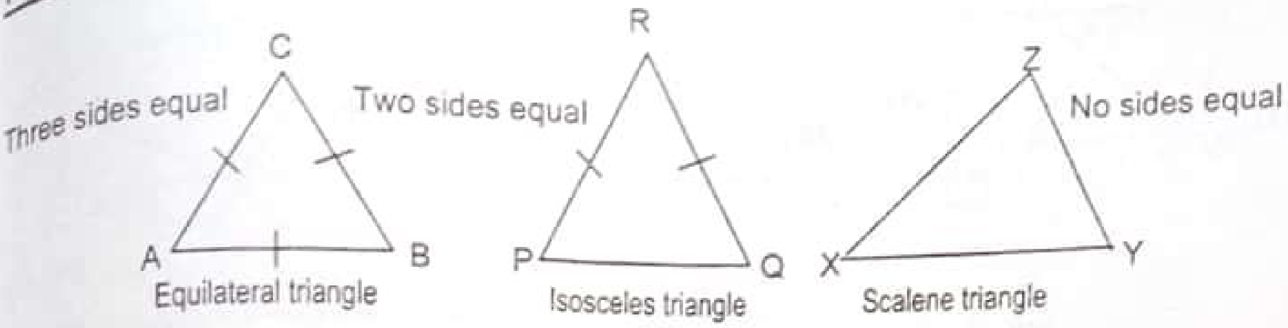


Fig. 1

Triangles can be classified according to:

(a) The number of equal sides



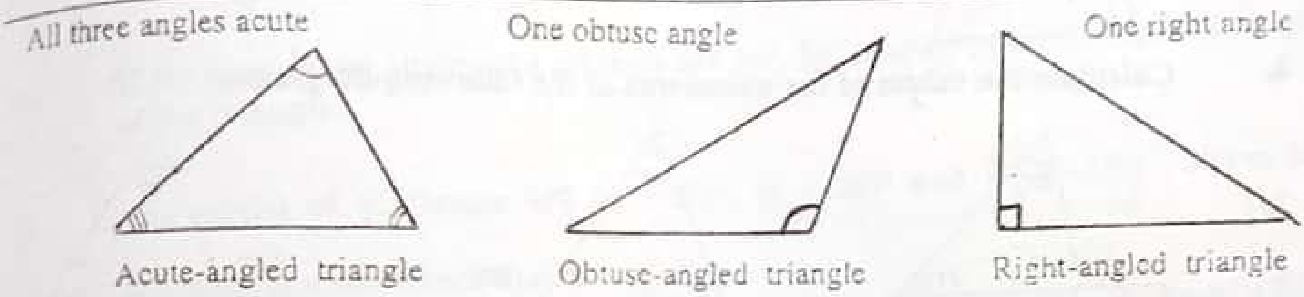
Equilateral triangle

Isosceles triangle

Scalene triangle

Fig. 2

(b) The types of angles



Acute-angled triangle

Obtuse-angled triangle

Right-angled triangle

Fig. 3

PRACTISING GEOMETRY

1. **Sketch, in each case, a triangle *ABC* with the size of A and *B* given below. In each case, find C and classify each triangle (i) by its sides (ii) by its angles:**

(a) $\hat{A} = 20^\circ$, $\hat{B} = 60^\circ$

(b) $\hat{A} = 70^\circ$, $\hat{B} = 40^\circ$

(c) $\hat{A} = 60^\circ$, $\hat{B} = 60^\circ$

(d) $\hat{A} = 42^\circ$, $\hat{B} = 48^\circ$

(e) $\hat{A} = 65^\circ$, $\hat{B} = 50^\circ$

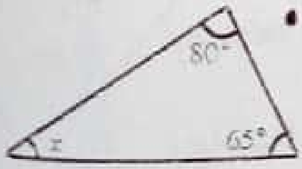
(d) $\hat{A} = 25^\circ$, $\hat{B} = 112^\circ$

2. **The following are base angles of isosceles triangles. In each case, find the third angle of the isosceles triangle:**

(a) 42° (b) 82° (c) 18° (d) 64°

3. **Calculate the values of the unknown angle in each of the following diagrams:**

(a)



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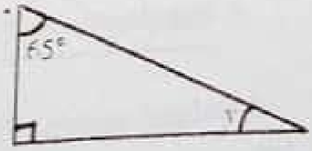

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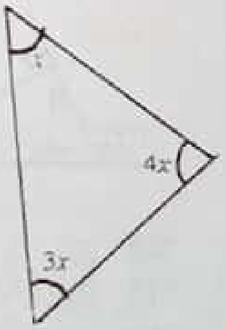

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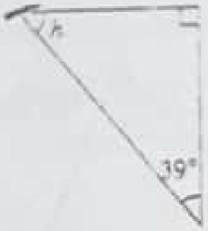

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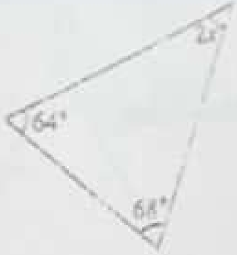
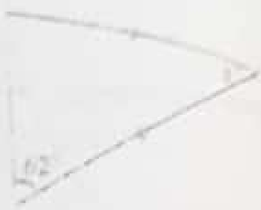
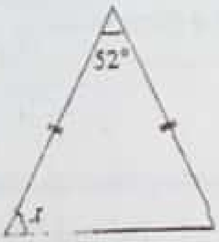


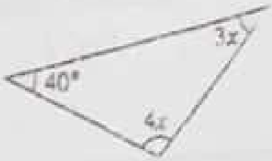
(f)



(g)

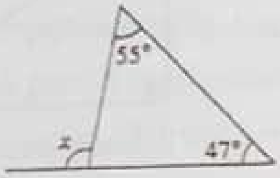


(h)

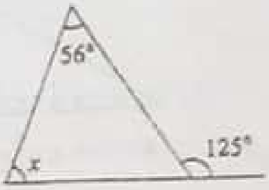


4. Calculate the values of the unknowns in the following diagrams:

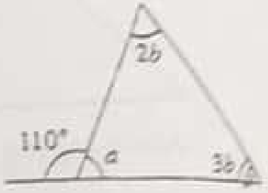
(a)



(b)



(c)



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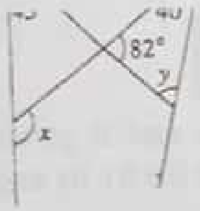

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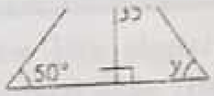

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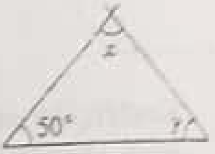

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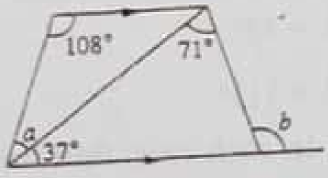

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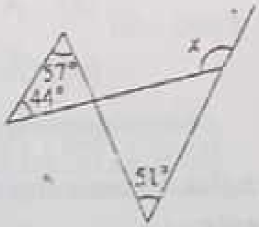
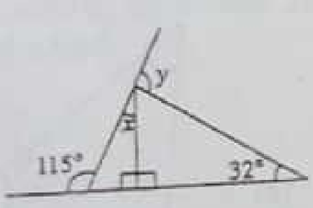
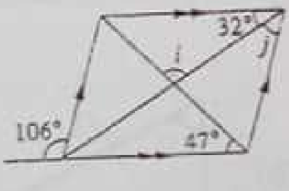


5. Calculate the values of the unknowns in the following diagrams:

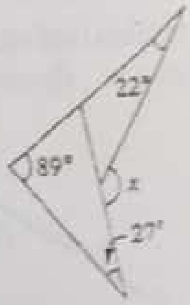
(a)



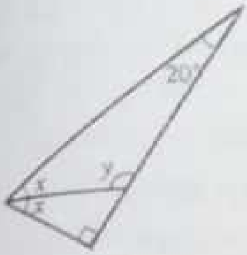
(b)



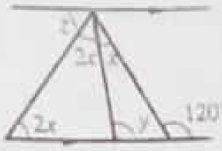
(c)



(d)



(e)



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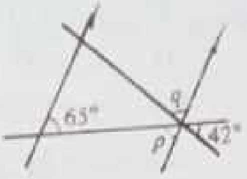

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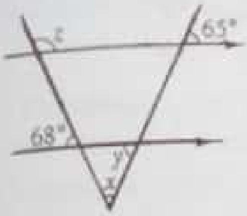

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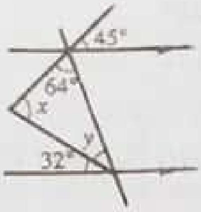


6. **If the sizes of the angles of a triangle are 3x°, 5x° and 4x°, find the smallest angle of the triangle.**

7. **The angles of a triangle are (x – 35)°, (x – 25)° and $\left(\frac{1}{2}x-10\right)^{\circ}$. Form an equation in *x* and hence find *x*.**

8. **In the triangle ABC, $\hat{A} = 50°$, $\hat{C} = 26°$ and AB is produced to D. Find $A\hat{B}C$ and $C\hat{B}D$.**

ANSWERS TO EXERCISE

1.
(a) 100°
(i) scalene Δ (ii) obtuse-angled Δ
(b) 70°
(i) isosceles (ii) acute-angled Δ
(c) 60°
(i) equilateral Δ (ii) acute-angled Δ
(d) 90°
(i) scalene Δ (ii) right-angled Δ
(e) 65°
(i) isosceles Δ (ii) acute-angled Δ
(f) 43°
(i) scalene Δ (ii) obtuse-angled Δ

2. (a) 96° (b) 16° (c) 144° (d) 52°
3. (a) 35° (b) 25° (c) 22.5° (d) 51°
(e) 24° (f) 56° (g) 64° (h) 20°

4. (a) 102° (b) 69° (c) $a = 70°, b = 22°$
(d) $x = 127°, y = 58°$ (e) $x = 40°, y = 55°$
(f) $x = 78°, y = 52°$ (g) $a = 35°, b = 108°$
(h) $x = 130°$

5. (a) $x = 25, y = 97°$ (b) $i = 101°, j = 42°$
(c) 138° (d) $x = 35°, y = 125°$
(e) $x = 24°, y = 96°, z = 48°$ (f) $p = 65°, q = 73°$
(g) $x = 47°, y = 65°, z = 112°$ (h) $x = 77°, y = 39°$

6. 45°

7. $(x - 35) + (x - 25) + \left(\frac{1}{2}x - 10\right) = 180;\ x = 10$

8. 104°, 76°

ALGEBRA

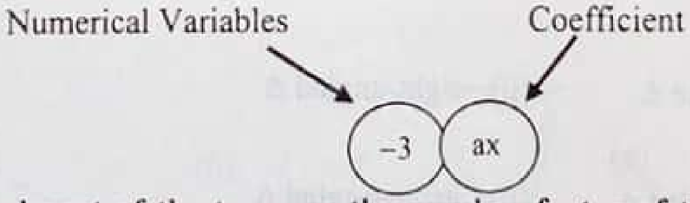
What is Algebra?

Algebra **is a branch of mathematics that uses mathematical statements** to describe **relationships between things that vary over time.** These variables include things like the relationship between supply of an object and its price. When we use a mathematical statement to describe a relationship, we often use letters to represent the quantity that varies, since it is not a fixed amount. These letters and symbols are referred to as *variables.*

The mathematical statements that describe relationships are expressed using *algebraic terms, expressions,* or *equations* (mathematical statements containing letters or symbols to represent numbers). Before we use algebra to find information about these kinds of relationships, it is important to first cover some basic terminology. In this unit we will first define *terms, expressions,* and *equations.* In the remaining units in this book we will review how to work with algebraic expressions, solve equations, and how to construct algebraic equations that describe a relationship. We will also introduce the notation used in algebra as we move through this unit.

Algebraic Terms

The basic unit of an algebraic expression is a term. In general, **a *term* is either a number or a product of a number and one or more variables.** Below is the term *−3ax.*



The numerical part of the term, or the number factor of the term, is what we refer to as the *numerical coefficient.* This numerical coefficient will take on the sign of the operation in front of it. The term above contains a numerical coefficient, which includes the arithmetic sign, and a variable or variables. In this case the numerical coefficient is −3 and the variables in the term are *a* and *x.* Terms such as *xz* may not appear to have a numerical coefficient, but they do. The numerical coefficient is 1, which is assumed.

Algebraic Expressions

An *expression* **is a meaningful collection of numbers, variables, and signs, positive or negative, of operations that must make mathematical and logical sense.** Expression is:

- contain any number of algebraic terms
- use signs of operation—addition, subtraction, multiplication, and division.
- do not contain an equality sign (=)

An example of an expression is:

$$-3ax + 11wx^2y$$

In an expression, the signs of operation separate it into terms. The sign also becomes part of the term that it follows. The expression above contains two terms, the first term is $-3ax$ and the second term is $+11wx^2y$. The addition sign separates the two terms. For example, in the expression given above the plus sign (+) separates the $-3ax$ from $11\,wx^2y$ and is also part of the second term. Terms that do not have a sign listed in front of them are understood to be positive.

Below are several examples that are *not* expressions.

$x + \bullet\, y$ This statement tells us "x plus multiplied by y". This does not make mathematical or logical sense. This collection of symbols is nonsense.

$y = 2x - 1$ This statement is not an expression because expressions are not allowed to contain the equal sign.

Note: The operation of multiplication can be represented by using a x, •, or by placing items to be multiplied in parentheses, brackets or braces, or in the case of variables, just written next to one another. The statements *a xb, a • b, (a)(b),* and *ab* are equivalent. In this booklet we will use the latter three representations.

Algebraic Equations

An *equation* **is a mathematical statement that two expressions are equal.** The following three statements are equations:

$$4 + 5 = 9 \qquad x - 35 = 56k^2 + 3 \qquad x + 3 = 15$$

The first equation, 4 + 5=9, contains only numbers; the other two, however, also contain variables. All three contain two *expressions* separated by an equal sign:

$$\overbrace{x - 35}^{\text{Expression}} = \overbrace{56k^2 + 3}^{\text{Expression}}$$

When an equation contains variables you will often have to solve for one of those variables. Using equations to solve for a variable will be discussed later in this booklet.

SOLVED EXAMPLES OF ALJEBRAIC EXPRESSIONS

Example 1: Write an algebraic expression for each of the following:

(a) Add 4x to 3y
(b) Subtract 6x from 13.
(c) Multiply m by 3n
(d) Divide 4k by 7x
(e) Add 2x to twice 3y
(f) Subtract 5x from half of y.

Solution:

(a) $4x + 3y$ (b) $13 - 6x$ (c) $m \times 3n = 3mn$

(d) $4k \div 7x = \frac{4k}{7x}$ f (e) $2x + 6y$ (f) $\frac{y}{2} - 5x$

Example 2: Evaluate $2x + 5y$ when

(a) $x = 3$ and $y = 5$ (b) $x = 2$ and $y = 1$ (c) $x = -2$ and $y = 3$

Solution:

(a) $2x + 5y = 2(3) + 5(5) = 6 + 25 = 31$

(b) $2x + 5y = 2(2) + 5(-1) = 4 - 5 = -1$

(c) $2x + 5y = 2(-2) + 5(3) = -4 + 15 = 11$

Example 3: Simplify the following expression:

(a) $4x + 8x - 2x$ (b) $3a - 2b + c - a + 5b$

Solution:

(a) $4x + 8x - 2x$
$= (4x + 8x) - 2x$
$= 12x - 2x$
$= 10x$

(b) $3a-2b+c-a+5b$
$= 3a - a - 2b + 5b + c$
$= 2a + 3b + c$

Example 4: Expand each of the following:

(a) $5(2x + 2y)$ (b) $3(3a + b) - 2(4a - 3b)$

Solution:

(a) $5(2x + 2y)$
$= 5 \times x2 + 5 \times 2y$
$= 10x - 10y$

(b) $3(3a + b) - 2(4a - 3b)$
$= 9a + 3b - 8a + 6b$
$= a + 9b$

Example 5: Find the sum of

$4a + 3b - 4c$, $3a - 2b$, $-4a + 5c$ and $a - 2b + c$

Solution:

$(4a + 3b - 4c) + (3a - 2b) + (-4a + 5c) + (a - 2b + c)$
$= 4a + 3b - 4c + 3a - 2b - 4a + 5c + a - 2b + c$
$= 4a - b + 2c$

Example 6: Subtract $4a - 2b + 6c$ from $3a + 3b - 4c$

Solution:

$(3a + 3b - 4c) - (4a - 2b + 6c)$
$= 3a + 3b - 4c - 4a + 2b - 6c$
$= -a + 5b - 10c$

Example 7: Simplify the following algebraic expression

$$\frac{4a + 3}{6} - \frac{a + 2}{2}$$

Solution:

$$\frac{4a + 3}{6} - \frac{a + 2}{2}$$

$$\frac{2(4a+3)-6(a+2)}{12}$$

$$= \frac{8a+6-6a-12}{12}$$

$$= \frac{2a-12}{12}$$

Example 8: Factorise the following:

(a) $5x - 35$ (b) $6ax + 12ay$

(c) $h(2x+3) + 2(2x+3)$ (d) $2h(2x+6) + 2(2x+6)$

Solution:

(a) $5x - 35$

$= 5 \times x - 5 \times 7$

$= 5(x - 7)$

(b) $6ax + 12ay$

$= 6 \times a \times x + 6 \times 2 \times a \times y$

$= 6a(x + 2y)$

(c) $h(2x+3) + 2(2x+3)$

$= (2x+3)(h+2)$

(d) $2h(2x+6) + 2(2x+6)$

$= (2h+2)(2x+6)$

$= (2h+2)(2x+6)$

TERMS OF ALGEBRA

Basic algebra terms you need to know are constants, variables, coefficients, terms, expressions, equations and quadratic equations. These are some algebra vocabulary that will be useful.

Constants: A fixed quantity that does not change. For example: 3, –6, π.

Variables

A variable is a symbol that we assign to an unknown value. It is usually represented by letters such as *x*, *y*, or *t*. For example, we might say that *l* stands for the length of a rectangle and w stands for the width of the rectangle. We use variables when we need to indicate how objects are related even though we may not know the exact values of the objects. For example, if we want to say that the length of a rectangle is 3 times the length of its width then we can write $\ell = 3 \times w$

Coefficients

The coefficient of a *variable* is the number that is placed in front of a variable.

For example, $3 \times w$ can be written as 3w and 3 is the coefficient.

Terms

A term can be any of the following:

- a constant: e.g. 3, 10, *n*.
- the product of a number (*coefficient*) and a *variable*: e.g. –3x, 11y,
- the product of two or more variables: e.g. x^2, xy, $2y^2$, $7xy$
- the product of two or more variables: e.g. ...

Like terms are terms that differ only in their numerical coefficients.

For example: 3a, *22a*, *40a* are like terms.

Expressions

An expression is made up of one or more terms.

For example: $3w + 4xy + 5$

Equations

An equation consists of two *expressions* separated by an equal sign. The expression on one side of the equal sign has the same value as the expression on the other side.

For example:

$$4 + 6 = 5 \times 2$$

$$\ell = 3 \times w$$

$$3w + 4xy + 5 = 2w + 3$$

Quadratic Equations

A Quadratic Equation is an *equation* of the form:

$Ax^2 + bx + c = 0$, where a, b and c are numbers and $a \neq 0$

For example:

$x^2 + 2x + 3 = 0$

$2x^2 + 5x - 7 = 0$

$2x^2 + 5x = 8$ is a quadratic equation because it can be changed to $2x^2 + 5x - 8 = 0$

$x^2 + x = 0$ is a quadratic with $c = 0$

$2x^2 - 7 = 0$ is a quadratic with $b = 0$

$2x + 3 = 0$ is not a quadratic because a cannot be 0

Degree of a polynomial – The degree of a term within a polynomial is the sum of the exponents of variables that occur in that term (if there is no exponent written on a variable, such as in 3x, the exponent is one). The degree of a polynomial is the greatest degree of any term in the polynomial (for instance, for the polynomial $4x^2 + 7xyz$, the degree is 3 because of the last term).

- If a polynomial isn't just a constant and if each term has at most a variable to the first power (like $4x - 2$ or $3y$), then it is a first-degree polynomial (also called a linear polynomial).
- If a polynomial's highest degree is two, it is a quadratic (or second-degree) polynomial (example: $4x^2 + 3x + 7$).
- If a polynomial has more than one variable, then its degree is the sum of the exponents of the highest-degree term. For example, the polynomial $2xy - 3xy + 6x - 2$ has degree 3 (the sum of the xy^2 exponents, 1 + 2).

Polynomials are often written in descending order, in which the terms with the largest powers are written first (like $9x^2 - 3x + 6$). If they are written with the smallest terms appearing first, this is ascending order (like $6 - 3x + 9x^2$).

Equation – An equation is a mathematical statement that contains an equal sign, like $ax + b = c$.

Exponent – An exponent is a power that a number is raised to. For example, in 2^3, the exponent is 3.

Expression – An algebraic expression consists of one or more variables, constants, and operations, like 3x – 4. Each part of an expression that is added or subtracted is called a *term*. For example, the expression $4x^2 - 2x + 7$ has three terms.

Factor – The factor of a number is a number that divides that number exactly. For example, the factors of 6 are 1, 2, 3 and 6.

Formula – A formula shows a mathematical relationship between expressions.

Fraction – A fraction is a part of a whole, like a half, a third, a quarter, etc. For example, half of an apple is a fraction of an apple. The top number in a fraction is called the numerator; the bottom number in a fraction is called the denominator.

Inequality – An inequality is a mathematical expression that contains an inequality symbol. The inequality symbols are:

$<$	less than ($1<2$)
$>$	greater than ($2>1$)
$\leq$	less than or equal to
$\geq$	greater than or equal to
$\neq$	not equal to ($1\neq2$).

Integer – The integers are the numbers ..., –3, –2, –1, 0, 1, 2,....

Inverse (addition) – The inverse property of addition states that for every number a, $a + (-a) = 0$ (zero).

Inverse (multiplication) – The inverse property of multiplication states that for every non-zero number a, a times $\left(\frac{1}{a}\right) = 1$.

Matrix –n^{th} –

Operation – An operation is a rule for taking one or two numbers as inputs and producing a number as an output. Some arithmetic operations are multiplication, division, addition, and subtraction.

Polynomial – A polynomial is a sum or difference of terms; each term is:

- a constant (for example, 5)
- a constant times a variable (for example, 3x)
- a constant times the variable to a positive integer power (for example, $2x^2$)
- a constant times the product of variables to positive integer powers (for example, $2x^3y$).

Monomial is a polynomial with only one term. A binomial is a polynomial that has two terms. A trinomial is a polynomial with three terms.

Square root – The square roots of a number n are the numbers s such that $s^2 = n$. For example, the square roots of 4 are 2 and –2; the square roots of 9 are 3 and –3.

Symbol – A symbol is a mark or sign that stands for something else. For example, the symbol ÷ means *divide*.

System of equations – A system of equations is two or more independent equations that are solved together. For example, the system of equations: $x + y = 3$ and $x - y = 1$ has a solution of $x = 2$ and $y = 1$.

Terms – In an expression or equation, terms are numbers, variables, or numbers wi variables.

For example, the expression 3x has one term, the expression $4x^2 + 7$ has two terms.

Variable – A variable is an unknown or placeholder in an algebraic expression. F example, in the expression $2x + y$, x and y are variables.

SOLVED EXAMPLES ON MULTIPLICATION

1. **Multiply $x^3(x^4 + 5a)$**

$x^3(x^4 + 5a)$

$= x^7 + 5ax^3$

2. **Multiply $(x + 5)(a - 6)$**

$(x + 5)(a - 6)$

$= x(a - 6) + 5(a - 6)$

$= ax - 6x + 5a - 30$

3. **Multiply $(2x + 3)(x^2 - x - 5)$**

We take the 2 terms of the first bracket and multiply both of them by the secon bracket.

$(2x + 3)(x^2 - x - 5)$

$= (2x)(x^2 - x - 5) + (3)(x^2 - x - 5)$

$= (2x^3 - 2x^2 - 10x) + (3x^2 - 3x - 15)$

$= 2x^3 + x^2 - 13x - 15$

This time we could collect together some like terms. There was:

$-2x^2 + 3x^2 - x^2$ and

$-10x - 3x = -13x$

4. **Multiply $(x - 3)^2$**

$(x - 3)^2$

$= (x - 3)(x - 3)$

$= x(x - 3) - 3(x - 3)$

$= x^2 - 3x - 3x + 9$

$= x^2 - 6x + 9$

5. **Simplify $5x[-4 + 10(x - y)] + 7x$**

$5x[-4 + 10(x - y)] + 7x$

$= 5x[-4 + 10x - 10y] + 7x$

$= -20x + 50x^2 - 50xy + 7x$

$= -13x + 50x^2 - 50xy$

6. **Simplify $13x + 7y - 2x + 6a$**

$3x + 7y - 2x + 6a$

$(13x - 2x) + 6a + 7y$

$= 6a + 11x + 7y$

We usually present our variables in alphabetical order, but it is not essential.

Simplify$-[7(a-2b)-4b]$

7. $-[7(a-2b)-4b]$

$= -[7a-14b-4b]$

$= -[7a-18b]$

$= -7a+18b$

MCQs IN BASIC ALGEBRA

1. **$4 \times 2 + 16x + 36$ is equivalent to?**

(a) $4(x2+4x+4)$ (b) $4(x+4)(x+4)$ (c) $4x(x+4+9)$

(d) $4(x2+6x+9)$ (e) $4(x2+6+9)$

Ans. (d)

2. **$(8/Z)+(6/Z)$ x $(40/Z)$ =? If $Z = 2$**

(a) 27 (b) 32 (c) 40 (d) 60 (e) 64

Ans. (e)

3. **$(a+b)^2+(b+c)2 =$**

(a) $a^2+2b^2+2ab+c^2+2bc$ (b) $a^2+b^2+c^2+2ab+2bc$ (e) None

(c) $a^2-b^2+c^2+2ab+2bc$ (d) $2a^2+2b^2+2c^2+ab+bc$

Ans. (a)

4. **$(x^2yz+xy^2z+xyz^2)/xyz$**

(a) $xy+xy+yz$ (b) $xy+yz+zx$ (c) $x+y+z$ (d) $x^2+y^2+z^2$

(e) $(x+y+z)/xyz$

Ans. (c)

5. **$(a+b)^2+(a-b)2 =$**

(a) $2(a^2+b^2)$ (b) $2(a^2+2b^2)$ (c) $4ab$ (d) $4(a+b)$

(e) $2(a^2+b^2)$

Ans. (a)

6. **If $x = 5$ $y = 4$ $z = 3$ then which of the following is true?**

(I) $x+y+z = 11$ (II) $x+y-z = -6$ (III) $x+Y+z$ 12 (IV) $-x+y-z = -4$

(a) I and II (b) III and IV (c) All (d) None

Ans. (b)

7. **$(12a^2-144a)/(a-12) = ?$**

(a) $12a$ (b) $12a^2$ (c) $11a$ (d) $144\ a \times a$

Ans. (a)

8. **$(9/a)+(21/a) \times (36/a) = ?$ If $a = 3$**

(a) 80 (b) 120 (c) 100 (d) 87

Ans. (d)

9. **$(x+y)2+(y+z)2 =$**

(a) $x2+y2+z2+2xy+4yz$ (b) $x2+y2+z2+4xy+2yz$

(c) x2 + 2y2 + z2 + 2y(x+z) (d) x2 + 2y2 + z2 + 2x(y+z) (e) None

Ans. (c)

10. **(x + y) – (x – y) 2 =**

(a) 2(x2 – y2) (b) 2(x2 + y2) (c) 2x2 – 2y2 – 2xy (d) 4xy

Ans. **(d)**

11. **If 5a = 2b = 40c what is the value of 8a + 5b in terms of c?**

(a) 10c (b) 164c (c) 52c (d) 25c (e) 82c

SET

A *set* is a well defined collection of objects such that given an object, it is possible to determine whether that object belongs to the given collection or not.

For example, the collection of all students of Punjab University is a set, whereas, collection of all good books on mathematics is not a set, since a mathematics book considered good by one person might be considered bad or average by another.

Notations The sets are usually denoted by capital letters *A*, *B*, *C*, etc. and the members or elements of the set are denoted by lower–case letters *a*, *b*, *c*. etc. If *x* is a member of the set *A*, we write $x \in A$. (read as '*x* belongs to *A*') and if *x* is not a member of the set *A*, we write $x \notin A$ (read as 'x does not belong to *A*'). If *x* and y both belong to *A*, we write x, yE*A*.

TYPES OF SET

Empty Set or Null Set:

A set which does not contain any element is called an empty set, or the null set or the void set and it is denoted by ϕ and is read as phi. In roster form, ϕ is denoted by {}. An empty set is a finite set, since the number of elements in an empty set is finite, i.e., 0.

For example: (a) The set of whole numbers less than 0.

(b) Clearly there is no whole number less than 0.

Therefore, it is an empty set.

(c) $N = \{x : x \in N, 3 < x < 4\}$

- Let A = {x : 2 < x < 3, x is a natural number}

  Here A is an empty set because there is no natural number between 2 and 3.
- Let B = {x : x is a composite number less than 4}.

  Here B is an empty set because there is no composite number less than 4.

Note: $\phi = \{0\}$ ∴ has no element.

{0} is a set which has one element 0.

The cardinal number of an empty set, i.e., $n(\phi) = 0$

Singleton Set:

A set which contains only one element is called a singleton set.

For example:

- A = {x : x is neither prime nor composite}

  It is a singleton set containing one element, i.e., 1.
- B = {x : x is a whole number, x < 1}

This set contains only one element 0 and is a singleton set.

- Let A = {x : x ∈ N and $x^2 = 4$}

Here A is a singleton set because there is only one element 2 whose square is 4.

- Let B = {x : x is a even prime number}

Here B is a singleton set because there is only one prime number which is even, i.e., 2.

FINITE SET

'A set which contains a definite number of elements is called a finite set. Empty set is also called a finite set.

For example:

- The set of all colors in the rainbow.
- N = {x : x ∈ N, x < 7}
- P = {2, 3,5, 7, 11, 13, 17, ...97}

INFINITE SET

The set whose elements cannot be listed, i.e., set containing never–ending elements is called an infinite set.

For example:

- Set of all points in a plane
- A = {x : x ∈ N, x > 1}
- Set of all prime numbers
- B = {x : x ∈ W, x = 2n}

Note: All infinite sets cannot be expressed in roster form.

For example: The set of real numbers since the elements of this set do not follow any particular pattern.

CARDINAL NUMBERS OF A SET

The number of distinct elements in a given set A is called the cardinal number of A. It is denoted by n(A).

For example:

- A {x : x ∈ N, x < 5}
  A = {1, 2, 3, 4}
  Therefore, n(A) = 4
- B = set of letters in the word ALGEBRA
  B = {A, L, G, E, B, R}

Therefore, n(B) = 6

EQUIVALENT SETS

Two sets A and B are said to be equivalent if their cardinal number is same, i.e., n(A) = n(B). The symbol for denoting an equivalent set is '↔'.

For example:

A = {1, 2, 3} Here n(A) = 3
B = {p, q, r} Here n(B) = 3
Therefore, A ↔ B

EQUAL SETS

Two sets A and B are said to be equal if they contain the same elements. Every element of A is an element of B and every element of B is an element of A.

For example:

$A = \{p, q, r, s\}$
$B = \{p, s, r, q\}$
Therefore, $A = B$

The various types of sets and their definitions are explained above with the help of examples.

SOLVED PROBLEMS

1. **If $n(U) = 60$, $n(A) = 35$, $n(B) = 24$ and $n(A \cup B)' = 10$ then $n(A \cap B)$ is**
   (a) 9 (b) 8 (c) 6 (d) None of these
2. **Let $A = \{2, 3, 4\}$ and $X = \{0, 1, 2, 3, 4\}$, then which of the following statements is correct?**
   (a) $\{0\} \in A'$ in X (b) $\phi \in A'$ w.r.t. X
   (c) $\{0\} \subset A'$ w.r.t. X (d) $0 \subset A'$ w.r.t. X.
3. **If $X = \{8n - 7n - 1 / n \in N\}$ and $Y = \{49(n - 1) / n \in N\}$, then**
   (a) $X \subset Y$ (b) $Y \subset X$
   (c) $X = Y$ (d) None of these
4. **The set $(A \cup B \cup C) \cap (A \cap B' \cap C')' \cap C'$ is equal to**
   (a) $A \cap B$ (b) $A \cap C'$
   (c) $B \cap C'$ (d) $B' \cap C'$
5. **If A, B and C are non-empty subsets of a set, then $(A - B) \cup (B - A)$ equals**
   (a) $(A \cap B) \cup (A \cup B)$ (b) $(A \cup B) - (A \cup B)$
   (c) $A - (A \cap B)$ (d) $(A \cup B) - B$
6. **Let A and B two non-empty subsets of a set X such that A is not a subset of B then**
   (a) A is subset of the complement of B
   (b) B is a subset of A
   (c) A and B are disjoint
   (d) A and the complement of B are non-disjoint
7. **Two finite sets have m and n elements, then total number of subsets of the first set is 56 more that the total number of subsets of the second. The values of m and n are,**
   (a) 7, 6 (b) 6, 3
   (c) 5, 1 (d) 8, 7
8. **Let U = R (the set of all real numbers) If $A = \{x : x \in R, 0 < x < 2\}$, $B = \{x : x \in R, 1 < x \leq 3\}$, then**
   (a) $A \cup B = \{x : x \in R \text{ and } 0 < x \leq 3\}$

(b) $A \cap B = \{x : x \in R \text{ and } 1 < x < 2\}$
(c) $A - B = \{x : x \in R \text{ and } 1 < x \leq 0\}$
(d) All of these

9. **If $Y \cup \{1, 2\} = \{1, 2, 3, 5, 9\}$, then**
(a) The smallest set of Y is $\{3, 5, 9\}$
(b) The smallest set of Y is $\{2, 3, 5, 9\}$
(c) The largest set of Y is $\{1, 2, 3, 4, 9\}$
(d) The largest set of Y is $\{2, 3, 4, 9\}$

10. **If A has 3 elements and B has 6 elements, then the minimum number of elements in the set $A \cup B$ is**
(a) 6
(b) 3
(c) ϕ
(d) None of these

11. **Suppose $A_1, A_2, \ldots\ldots A_{30}$ are thirty sets each with five elements and $B_1, B_2, \ldots, B_n$ are n sets each with three elements. Let**

$$\bigcup_{i=1}^{30} A_i = \bigcup_{i=1}^{n} B_i = S$$

If each element of S belongs to exactly ten of the A_i's and exactly nine of the B_i's then n =
(a) 45
(b) 35
(c) 40
(d) None of these

12. **If $A = \{1, 3, 5, 7, 9, 11, 13, 15, 17\}$, $B = \{2, 4, \ldots\ldots, 18\}$ and N is the universal set, then $A' \cup (A \cup B) \cap B')$ is**
(a) A
(b) N
(c) B
(d) None of these

13. **If X and Y are two sets and X′ denotes the complement of X, then $X \cap (X \cup Y)'$ equals**
(a) X
(b) y
(c) ϕ
(d) None of these

14. **In a group of 65 people, 40 like cricket, 10 like both cricket and tennis. The number of persons liking tennis only and not cricket is**
(a) 21
(b) 25
(c) 15
(d) None of these

15. **In a group of 1000 people, there are 750 people who can speak Urdu and 400 who can speak English. Then number of persons who can speak Urdu only is**
(a) 300
(b) 400
(c) 600
(d) None of these

16. **If $f : R \rightarrow R$, defined by $f(x) = x^2 + 1$, then the values of $f^{-1}(17)$ and $f^{-1}(-3)$ respectively are**
(a) $\phi, \{4, -4\}$
(b) $\{3, -3\}, \phi$
(c) $\phi, \{3, -3\}$
(d) $\{4, -4\}, \phi$

17. In a statistical investigation of 1,003 families of Karachi, it was found that 63 families had neither a radio nor a TV, 794 families had a radio and 187 had a TV. The number of families in that group having both a radio and a T.V is
    (a) 36 (b) 41
    (c) 32 (d) None of these

18. In a city, three daily newspapers A, B, C are published. 42% of the people in that city read A, 51% read B and 68% read C. 30% read A and B; 28% read B and C; 36% read A and C; 8% do not read any of the three newspapers. The percentage of persons who read all the three papers is
    (a) 25% (b) 18%
    (c) 20% (d) None of these

19. Let n be a fixed positive integer. Let a relation R be defined on I (the set of all integers) as follows: a R b if n/(a−b), that is, if a − b is divisible by n, then, the relation R is
    (a) reflexive only (b) symmetric only
    (c) transitive only (d) an equivalence relation.

20. Let R be a relation defined as a R b if $|a - b| > 0$. Then, the relation R is
    (a) reflexive (b) symmetric
    (c) transitive (d) None of these

21. Let R be a relation defined as a R b if $1 + ab > 0$. Then, the relation R is
    (a) reflexive (b) symmetric
    (c) transitive (d) none of these

22. Let R be a relation defined as a R b if $|a| < b$. Then, relation R is
    (a) reflexive (b) symmetric
    (c) transitive (d) none of these

23. N is the set of natural numbers. The relation R is defined on N × N as follows (a,b) R (c, d) ⇔ $a + d = b + c$. Then, R is
    (a) reflexive only (b) symmetric only
    (c) transitive only (d) an equivalence relation

24. Out of 800 boys in a school, 224 played cricket, 240 played hockey and 336 played basketball. Of the total, 64 played both basketball and hockey; 80 played cricket and basketball and 40 played cricket and hockey; 24 played all the three games. The number of boys who did not play any game is
    (a) 160 (b) 240
    (c) 216 (d) 128

25. Let S = {1, 2, 3, 4, 5} and let A = S × S. Define the relation R on A as follows (a, b) R (c, d) if and only if $ad = cb$. Then, R is
    (a) reflexive only (b) symmetric only
    (c) transitive only (d) equivalence relation

26. The relation 'less than' in the set of natural numbers is
    (a) only symmetric (b) only transitive

(c) only reflexive
(d) equivalence relation

27. **If R and R' are symmetric relations (not disjoint) on a set A, then the relation $R \cap R'$ is**

(a) reflexive
(b) symmetric
(c) transitive
(d) none of these

28. **With reference to a universal set, the inclusion of a subset in another, is relation which is**

(a) symmetric only
(b) equivalence
(c) reflexive only
(d) none of these

29. **Let R be the relation on the set R of all real numbers defined by a R b if $|a-b| \le 1$. Then R is**

(a) reflexive
(b) symmetric
(c) transitive
(d) anti–symmetric

30. **In a certain town 25% families own a phone and 15% own a car, 65% families own neither a phone nor a car. 2000 families own both a car and a phone. Consider the following statements in this regard:**

1. 10% families own both a car and a phone.
2. 35% families own either a car or a phone.
3. 40,000 families live in the town.

Which of the above statements are correct?

(a) I and 2
(b) 1 and 3
(c) 2 and3
(d) 1, 2 and 3

31. **If R is a relation '<' from, $A = \{1, 2, 3, 4\}$ to $B = \{1, 3, 5\}$; i.e., $(a, b) \in R$ if $a < b$, then $R \circ R^{-1}$ is**

(a) [(1,2), (1,5),.(2,3)(2,5)(3,5),(4,5)]
(b) [(3,1), (5,1), (5, 2), (5, 3), (5, 4)]
(c) [(3, 3), (3, 5), (5, 3), (5, 5)]
(d) [(3, 3), (?, 4), (4, 5)]

32. **If P, Q and R are subsets of a set A, then $R \times (P' \cup Q')'$ equals**

(a) $(R \times P) \cap (R \times Q)$
(b) $(R \times Q) \cap (R \times P)$
(c) $(R \times P) \cup (R \times Q)$
(d) none of these

33. **A relation R on the set of complex numbers is defined by, $z_1 R z_2 \Leftrightarrow \frac{z_1 - z_2}{z_1 + z_2}$ is real, then the relation R is**

(a) equivalence
(b) only reflexive
(c) only transitive
(d) none of these

34. **If sets A and B are defined as**

$A = \{(x, y) : y = e^x, x \in R\}$

$B = \{(x, y) : y = x, x \in R\}$ then

(a) $B \subset A$
(b) $A \subset B$

(c) $A \cap B = \phi$ (d) $A \cup B = A$

35. **The solution of $3x^2 - 12x = 0$ when**

(a) $x \in N$ is $\{4\}$ (b) $x \in I$ is $\{0, 4\}$

(c) $x \in S = (a + ib : b \neq 0, a, b \in R\}$ is ϕ

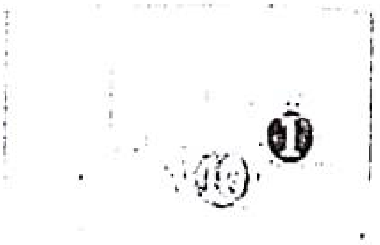
(d) all of these

ANSWERS

1.	(a)	2.	(c)	3.	(a)	4.	(c)	5.	(b)	6.	(d)	7.	(b)
8.	(d)	9.	(c)	10.	(a)	11.	(a)	12.	(b)	13.	(c)	14.	(b)
15.	(c)	16.	(d)	17.	(b)	18.	(a)	19.	(d)	20.	(b)	21.	(a,b)
22.	(c)	23.	(d)	24.	(a)	25.	(d)	26.	(b)	27.	(b)	28.	(c)
29.	(c,b)	30.	(c)	31.	(c)	32.	(a)	33.	(a)	34.	(c)	35.	(d)

ROUNDING NUMBERS

A rounded number has **about the same value** as the number you start with, **but it is less exact.**



For example, 341 rounded to the nearest hundred is 300. That is because 341 is closer in value to 300 than to 400. When rounding off to the nearest dollar, $1.89 becomes $2.00, because $1.89 is closer to $2.00 than to $1.00

RULES FOR ROUNDING

Here's the general rule for rounding:

- **If the number you are rounding is followed by 5, 6, 7, 8, or 9, round the number up.** Example: 38 rounded to the nearest ten is 40
- **If the number you are rounding is followed by 0, 1, 2, 3, or 4, round the number down.** Example: 33 rounded to the nearest ten is 30

WHAT ARE YOU ROUNDING TO?

When rounding a number, you first need to ask: **what are you rounding it to?** Numbers can be rounded to the nearest ten, the nearest hundred, the nearest thousand, and so on.

Consider the number 4,827.

- 4,827 rounded to the nearest ten is 4,830
- 4,827 rounded to the nearest hundred is 4,800
- 4,827 rounded to the nearest thousand is 5,000

All the **numbers to the right of the place you are rounding to become zeros.** Here are some more examples:

- 34 rounded to the nearest ten is 30
- 6,809 rounded to the nearest hundred is 6,800

- 1,951 rounded to the nearest thousand is 2,000

Rounding and Fractions

Rounding fractions **works exactly the same way** as rounding whole numbers. The only difference is that instead of rounding to tens, hundreds, thousands, and so on, you round to tenths, hundredths, thousandths, and so on.

- 7.8199 rounded to the nearest tenth is 7.8
- 1.0621 rounded to the nearest hundredth is 1.06
- 3.8792 rounded to the nearest thousandth is 3.879

Here's a tip: to **avoid getting confused** in rounding long decimals, **look only at the number in the place you are rounding to and the number that follows it.** For example, to round 5.3824791401 to the nearest hundredth, just look at the number in the hundredths place—8—and the number that follows it—2. Then you can easily round it to 5.38.

ROUNDING AND SUMS

Rounding can **make sums easy.** For example, at a grocery store you might pick up items with the following prices:

- $2.25
- $0.88 V
- $2.69

If you wanted to know about how much they would cost, you could add up the prices with a pen and paper, or try to add them in your head. Or you could do it the simple way—you could estimate by rounding off to the nearest dollar, like this:

- $2.00
- $1.00
- $3.00

By rounding off, you could easily figure out that you would need about $6.00 to pay for your groceries. This is pretty close to the exact number of $5.82.

As you can see, in finding a round sum, it is quickest to **round the numbers before adding them.**

1. Some statisticians prefer to round 5 to the nearest even number. As a result, about half of the time 5 will be rounded up. and about half of the time it will be rounded down. In this way, 26.5 rounded to the nearest even number would be 26—it would be rounded down. And, 77.5 rounded to the nearest even number would be 78—it would be rounded up.

CHAPTER 7

LOGICAL REASONING AND ANALYTICAL REASONING/ABILITY

LOGICAL REASONING

Informally, two kinds of **logical reasoning** can be distinguished in addition to formal deduction; induction and abduction. Given a precondition or *premise, a* conclusion or *logical consequence* and a rule or *material conditional* that implies the *conclusion* given *the precondition,* one can explain that:

- **Deductive reasoning** determines whether the truth of a *conclusion can* be determined for that *rule,* based solely on the truth of the premises. Example: "When it rains, things outside get wet. The grass is outside, therefore, when it rains, the grass gets wet." Mathematical *logic* and *philosophical logic* are commonly associated with this type of reasoning.
- **Inductive reasoning** attempts to support a determination of the *rule.* It hypothesizes a *rule* after numerous examples are taken to be a *conclusion* that follows from a *precondition* in terms of such a *rule.* Example: "The grass got wet numerous times when it rained, therefore, the grass always gets wet when it rains." While they may be persuasive, these arguments are not deductively valid, see the problem of induction. *Science* is associated with this type of reasoning.
- **Abductive reasoning,** aka *inference to the best explanation,* selects a cogent set of *preconditions.* Given a true *conclusion* and a *rule,* it attempts to select some possible *premises* that, if true also, can support the *conclusion,* though not uniquely.

Example: "When it rains, the grass gets wet. The grass is wet. Therefore, it might have rained." This kind of reasoning can be used to develop a *hypothesis,* which in turn can be tested by additional reasoning or data. *Diagnosticians, detectives,* and *scientists* often use this type of reasoning.

What is the Fundamental Difference between critical, analytical and logical reasoning?

Critical reasoning is fundamentally dialogic, which is to say it potentially broadens the conversation or inquiry. Critical capacities take aim at or their point of departure from another thinker, another writer, another conversationalist or another artist. Because its aim is to take the measure of some other intellectual or artistic endeavor critical reasoning essentially assesses, it examines, it tests the value of the object of inquiry (or desire). Such criticism is not necessarily harsh or negative, but it provides a suitable context or background against which one can better appreciate the object of the critical thinking. I love to read good criticism. It allows me to keep abreast of my ignorance.

Analytic reasoning grapples with facts, observations and data. It squeezes them, and, if successful, produces information. There is often a component of methodology invoked in analytic reasoning and this method is what gets applied by the analyst and the process we call—what else—analysis. Thus we prize critical reasoning for its insight and, often, its creativity; analytic reasoning, on the other hand, is disciplined, methodical—maybe even relentless. Analytic reasoning demonstrates to us that there is more than meets the eye, but simultaneously reminds us that that this truth would have remained hidden without some focused inquiry. When I read good analytic thinking, I have to pay attention, read closely and take the risk that the technical apparatus employed may elude me. As mental exertion goes, analytic reasoning is heavy lifting.

Logical reasoning takes us under the hood of rationality. We are alert to where assumptions end and facts pick-up. When conclusions are drawn, we cast our gaze back to the evidence and then the warrant, conducting a kind of stress-testing of the thinking. Logical thinking takes care to construct a strong and reliable superstructure, which is itself built of language, definitions and other concepts and categories that collectively lubricate the mechanism of clear thinking.

In each question below are given two statements followed by two conclusions numbered I and II. You have to take the given two statements to be true even if they seem to be at variance from commonly known facts. Read the conclusion and then decide which of the given conclusions logically follows from the two given statements, disregarding commonly known facts.

Give answer:

- (A) If only conclusion I follows
- (B) If only conclusion II follows
- (C) If either I or II follows
- (D) If neither I nor II follows and
- (E) If both I and II follow.

1. **Statements:** No women teacher can play. Some women teachers are athletes.

Conclusions:

I. Male athletes can play.
II. Some athletes can play.

(a) Only conclusion I follows
(b) Only conclusion follows
(c) Either I or II follows
(d) Neither I nor II follows
(e) Both I and II follows

2. **Statements:** All bags are cakes. All lamps are cakes.

Conclusions:

I. Some lamps are bags.
II. No lamp is bag.

(a) Only conclusion I follows
(b) Only conclusion II follows
(c) Either I or II follows
(d) Neither I nor II follows

(e) Both I and II follow

3. **Statements:** All mangoes are golden in colour. No golden-coloured things are cheap.

Conclusions:

I. All mangoes are cheap.

II. Golden-coloured mangoes are not cheap.

(a) Only conclusion I follows (b) Only conclusion II follows

(c) Either I or II follows (d) Neither I nor II follows

(e) Both I and II follow

4. **Statements:** Some kings are queens. All queens are beautiful.

Conclusions:

I. All kings are beautiful. II. All queens are kings.

(a) Only conclusion I follows (b) Only conclusion II follows

(c) Either I or II follows (d) Neither I nor II follows

(e) Both I and II follow

5. **Statements:** Some doctors are fools. Some fools are rich.

Conclusions:

I. Some doctors are rich II. Some rich are doctors.

(a) Only conclusion I follows (b) Only conclusion II follows

(c) Either I or II follows (d) Neither I nor II follows

(e) Both I and II follow

DEDUCTIVE REASONING SKILLS

Deductive reasoning skills are crucial in mathematics (as well as in many other walks of life). However, achieving a high level of student competence in deductive reasoning will require great care on the part of teachers. Indeed, the level of precision necessary to communicate mathematics is quite high, and it is easy for the generalist to overlook this. 'Three times higher than' does not mean the same thing as 'three times as high as'. The phrases 'six divided by three', 'six divides three', and 'six divided into three' all have different mathematical meanings. It is difficult to use deductive reasoning effectively without attention to this precision. All involved should be encouraged to cultivate careful reading, listening, presenting, and writing skills in the domain of mathematics.

The problems below all involve deductive reasoning, but they are of several types. First there are problems that require an understanding of quantifiers ('for some', 'for all'), negation' ('not all', 'some are not', etc.), and other mathematical language. Students need to understand this language and to evaluate whether a given statement involving quantifiers is true. They also need to learn that a statement that is only true sometimes is mathematically false (e.g. the statement 'the product of two irrationals is irrational is false). Second are problems that require understanding of 'if-then' deductive reasoning itself. Such problems come in a wide variety of levels and a wide range of sophistication, including multi-step implications. It is useful for working with 'if-then' statements to know that a statement and its contra positive are logically equivalent and to be able to formulate the contra positive of a given statement. However, this is only one, limited, part of working with 'if then' statements. It is the ability to carry out multi-step deductive reasoning and the ability to detect incorrect implications and explain why they are wrong that are the primary goals here. At the highest level are problems that couple this reasoning with algebra or geometry.

Problems involving quantifiers and other mathematical language

1: Decide which of the following statements are true and which are false. Explain your answer.

(a) Some whole numbers are integers.
(b) Some whole numbers are not integers.
(c) Some integers are whole numbers.
(d) Some integers are not whole numbers.
(e) Not all integers are whole numbers.
(f) All integers are whole numbers.
(g) Different fractions necessarily represent different rational numbers.
(h) Between any two rational numbers there is at least one other rational number.
(i) A system of two simultaneous linear homogeneous equations in two unknowns necessarily has at least one solution.

Discussion: Statements (a) to (f) involve three things: understanding the quantifiers 'some' and 'all', understanding that 'not' is attached to the noun that follows it (as opposed to negating the entire sentence), and understanding the concepts 'integer' and 'whole number'. The fact that 'not' sometimes negates an entire sentence and other times negates only an aspect of the sentence may cause some students difficulty (a difficulty that also occurs in ordinary communication). However, with explanations from the teacher, students can become proficient at analyzing and explaining such statements in the early grades.

Statement (g) requires understanding the phrase 'necessarily represent' and understanding the difference between a statement sometimes being true and always being true. The mathematical fact involved is one that must be mastered in order to work with fractions.

The problem of deciding whether statement (h) is true or false and explaining the reason is a somewhat sophisticated problem about a basic concept. The logic aspect of the problem is centered around the use of the phrase 'at least' (a phrase that is especially difficult for those who are just learning English) and around the requirement that the answer be explained.

The last statement involves standard mathematics terminology, some mathematical knowledge, and a correct understanding of the phrase 'at least'.

2. Decide which of the following statements are true and which are false. Explain your answer.

(a) All equilateral triangles are isosceles.
(b) Some isosceles triangles are right triangles.
(c) Some right triangles are isosceles.
(d) Some equilateral triangles are right triangles.
(e) Some isosceles triangles are right triangles and equilateral.
(f) No isosceles triangle is equilateral.
(g) Not all isosceles triangles are equilateral or right triangles.

Discussion: These are similar to problem 1, but based on geometry, in this case on the definition of various kinds of triangles. For part (g), note that in mathematics 'or' means 'one or the other or both'.

Problems 1 and 2 are meant to be representative; other variations which concern the same aspect of mathematical reasoning in the context of other aspects of math knowledge are readily constructed.

Problems involving 'if-then' statements and deductive reasoning

3. Which of the following statements is logically equivalent to "If it is Saturday, then I am not in school."?
   (1) If I am not in school, then it is Saturday.
   (2) If it is not Saturday, then I am not in school.
   (3) If I am in school, then it is not Saturday.
   (4) If it is Saturday, then I am in school.

Discussion: This is Problem 8 on Regents High School Examination Mathematics A of the State of New York for June 17, 2003. It requires a student to know what 'logically equivalent' means (a high school student should know the meaning of this phrase). The student must also be able to work with 'if, 'then', and 'not'. A nice feature of this problem is that it is written in the present tense, thus avoiding any concerns about causality.

One might contrast this with the problem "What is the inverse of the statement: 'If John cuts the grass, then he earns $8.00'?" This tests only the definition of the 'inverse' of an 'if-then' statement, a definition which is considerably less important than the contra-positive (or the converse). It does not test deductive reasoning at a high level.

4. Which of the following statements has a true converse?
   (a) If two triangles are congruent, then they have the same perimeter.
   (b) If two squares are congruent, then they have the same area.
   (c) If two rectangles have the same perimeter, then they have the same area.
   (d) If the area of a triangle is less than 1, then each of its sides has length less than 1.

Discussion: These problems illustrate that a statement and its converse may both be true, both be false, or one may be true and the other false. It is a common mistake to confuse the truth of a statement with the truth of its converse, both in mathematics and in the larger world. The ability to detect such potentially false reasoning is a basic life skill.

5. Some kings have beards. All kings wear red. All men who wear red are tall. Based solely on this information, which of the following statements are true?
   (a) Some men with beards are tall.
   (b) All tall men are kings.
   (c) Not all small men with beards wearing red are kings.

Discussion: This is a familiar type of problem and we do not list the possibilities exhaustively. Such problems should be mastered.

6. A, B, C, D and E are friends, no two of whom have the same height. B is taller than C, A is not the tallest, E is taller than B, D is taller than exactly two of the others, and D is taller than B. What is the order of the heights of these friends from tallest to shortest?

Discussion: Once again, this is a familiar type of deductive reasoning problem. The point is that there is one answer and it can be arrived at deductively.

7. Joshua and Joel together have the same number of scarves as Sarah and Samantha together. Also, Joshua has more scarves than Sarah. What can you conclude?

Discussion: This problem is suitable for the elementary level, but it may be more useful for a classroom discussion or homework than for a test. One can also ask the related problem in an algebraic format: If (a) to (f) $6 = c + d$ and $a < c$, what can you conclude? Similarly, some of the algebraic statements in problem 8 below can be made into word problems.

8. Decide which of the following statements about real numbers are true and which are false. If the statements are true, give an argument which shows this. If the statements are false, give a counter example.

(a) If $a < b$ and $c < d$ then $ac < bd$.

(b) If $a^2 < 6^2$ then $a < b$.

(c) If $a^3 < 6^3$ then $a < b$.

(d) If $(x + y)^2 = x^2 + y^2$ then $x = 0$ or $y = 0$.

(e) If x^2 — y^2 then x — y.

(f) x^3 — y^3 if and only if x — y.

Discussion: Statement (a) is a good example of an erroneous implication one might write in an algebra class. (b) Plausible-looking is not the same thing as true! Statement (c) requires understanding a property of the function $f(x) = x^3$. Statement (d) is true and the student should be able to give a complete proof by the time they complete a first course concerning algebra. Statement (e) is the converse of a true statement. However, it is false. Just as in the geometric context of problem 4, it is important for algebra that students understand clearly that the converse of a true if-then statement need not be true. Statement (f) uses the phrase 'if and only if.

9. Malcom says that

$$\frac{8}{11} > \frac{7}{10}$$

because $8 > 7$ and $11 > 10$. Even though it is true that $\frac{8}{11} > \frac{7}{10}$, is Malcom's reasoning correct? If Malcolm's reasoning is correct, explain why clearly; if Malcolm's reasoning is not correct, give Malcolm an example that shows why not. [This problem comes directly from Mathematics *for Elementary Teachers* by S. Beckmaim, Pearson Addison Wesley 2005, pg. 93, problem 15.]

Discussion: In this case the statement $\frac{8}{11} > \frac{7}{10}$ is true but the reasoning offered to justify it is not correct. Indeed, the justification offered is based on the false statement: 'If $0 < a < b$ and $0 < c < d$, then $\frac{a}{c} < \frac{b}{d}$.' It is important that students learn that such reasoning, even when used to justify something true, is not mathematically valid. Note that though the algebraic form of the false statement requires sophisticated algebra skills to understand (and debunk), the problem as stated is suitable for middle school students.

In conclusion, we echo the Lead Essay in emphasizing that the mathematical reasoning skills whose development is promoted here should also play a role in the way that mathematics is presented in the curriculum. To illustrate this, we offer two problems that could form bases for classroom discussions that involve mathematical reasoning.

10. Your best, friend knows that 'two wrongs don't make a right'. This friend can not believe that for numbers, a negative times a negative is a positive. Explain to your friend why the product of two negative numbers must always be positive.

Discussion: This basic fact about multiplication is sometimes presented to students as a "rule" without full justification, but it can be explained. The explanation requires an application of the distributive law and is somewhat subtle.

11. If the sum of the digits of an integer, written in base 10, is divisible by 3, then the number itself is divisible by 3. Explain why this is true for integers with two or three digits.

Discussion: This is a sophisticated problem concerning the reason why an 'if-then' statement is true. The solution requires an understanding of the base 10 number system and the knowledge that 10 and 100 each have remainder 1 upon division by 3. Once students have understood this divisibility test for two and three digit numbers one could ask them to explain it in general.

SOME LOGICAL REASONING QUESTIONS

1. When asked how old she was, Beth replied "In two years I will be twice as old as I was five years ago". How old is she?
2. Which weighs more? A pound of iron or a pound of copper?
3. If you have two coins totaling lip, and one of the coins is not a penny, what are the two coins?
4. Divide 40 by half and add ten. What is the answer?
5. To the nearest cubic centimetre, how much soil is there in a 3m × 2m × 2m hole?
6. A farmer has 15 cows, all but 8 die. How many does he have left?
7. The ages of a mother and her graduate son add up to 66. The mother's age is the son's age reversed. How old are they?
8. If a man and a half can eat a hot dog and a half in a minute and a half, how long would it take six men to eat six hot dogs?
9. Nim went into a supermarket to buy some fruit. There were three packs on special offer:
   (a) Ten grapes and five strawberries: 70p (save 10p)
   (b) Ten strawberries and ten apricots: £2 (save 40p)
   (c) Thirty grapes: 100p (save 20p)
   What would be the full price of one grape, one strawberry and one apricot at normal price (no special offers)?
10. The amount of water flowing into a tank doubles every minute. The tank is full in an hour. When is the tank half full?

11. There is a pole in a lake. Half of the pole is embedded in the mud at the bottom of the pond, another one-third is covered by water, and 7 feet is out of the water. What is the total length of the pole?

12. If the hour hand of a clock moves 1/60th of a degree every minute, how many degrees will it move in an hour?

13. I spend a third of my money on a guitar, half the rest on a microphone and a quarter of what I then have left on a kazoo. What proportion of my original money do I have left?

14. How can you take 1 from 19 and leave 20?

15. Here is a list of months and a code for each

(a) January: 7110
(b) February: 826
(c) March: 5313
(d) April: 541
(e) May: 3513
(f) June: 4610
(g) July: 4710

What is the code for the month of August?

16. There are 60 sweets in a jar. The first person took one sweet, and each consecutive person took more sweets than the person before, until the jar was empty.

What is the largest number of people that could have eaten sweets from the jar?

17. At the University of Kent 36 students attended the LAW lecture, 39 attended an ART lecture and 37 attended the DRAMA lecture. How many attended the FILM lecture?

18. If you have a pizza with crust thickness 'a' and radius 'z', what's the volume of the pizza?

19. A man went into a store to buy an item. He asked the assistant:
"How much does it cost for one?"
The assistant replied 2 pounds, Sir"
"And how much for 10?"
The assistant replied "£4"
"How much for 100?"
He got the reply "£6"
What was the man buying?

20. There are 23 football teams playing in a knockout competition. What is the least number of matches they need to play to decide the winner?

21. How many degrees are there between clock hands at 3.15?

22. You have 8 bags of sugar, 7 weight the same, one weighs less. You also have a balance scale. Find the one that weighs less in less than 3 steps.

23. There are three boxes, one contains only apples, one contains only oranges, and one contains both apples and oranges. The boxes have been incorrectly labeled such that no label identifies the actual contents of the box it labels. Opening just one box, and without looking in the box, you take out one piece of fruit. By looking at the fruit, how can you immediately label all of the boxes correctly?

24. $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{6}{7}$ of $\frac{7}{8}$ of $\frac{8}{9}$ of $\frac{9}{10}$ of 1,000 = ?

25. How many times do the hands of a clock overlap in 24 hours?

ANSWERS

1. 12
2. They both weigh exactly a pound!
3. 10p and 1p – the other coin can be a penny!
4. 90. Dividing by half is the same as multiplying by 2.
5. None – it's a hole!
6. Eight
7. 42 and 24 years old. (One reader has pointed out that it could also be 51 and 15)
8. A minute and a half
9. Thirty grapes at normal price cost £1.20, thus grapes cost 4p each. Ten grapes and 5 strawberries cost 80p at normal price, the grapes must cost 40p therefore the strawberries cost 8p each. Ten strawberries and ten apricots cost £2.40 at normal price, the strawberries cost 80p, therefore the apricots cost 16p each. So one apricot + one strawberry and one grape cost 28p in total.
10. At 59 minutes
11. Half of the pole is in the mud.

    One third is covered by water.

    Therefore fraction of pole in the mud and water = $\frac{1}{2} + \frac{1}{3} = \frac{3}{6} + \frac{2}{6} = \frac{5}{6}$

    Therefore fraction of pole out of the water = $1 - \frac{5}{6} = \frac{1}{6}$

    So one-sixth of the pole is 7 feet.

    So total length of pole = 42 feet.
12. One degree
13. After spending one-third of my money on the guitar I have two-thirds left. I spend half of this on a microphone, so this is again one-third. I then have one-third of my original money remaining. I spend one quarter of this on the kazoo. One quarter of one-third is one-twelfth. I thus have three quarters of one-third of my money remaining. Three quarters of one third is one quarter of my money remaining. (1/3 = 4/12. 4/12 - 1/12 = 3/12. 3/12 = 1/4)
14. If the numbers are in Roman numerals, Take I from XIX (19 in Roman numerals), you are left with XX – 20 in Roman numerals.
15. **681.** The first digit is the number of letters, the second, the position of the month in the calendar, and the final digit is the position of the first letter of the word in the alphabet.
16. The first person takes 1 sweet, the second two, the third three etc.

    1+ 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 55, so the first ten people take 55 sweets between them. The 11th person has to be content with a mere 5 sweets, making 11 people in total.
17. 40 students. Letter A = 1, B= 2, C = 3 and so forth, so FILM = 6 + 9 + 12 + 13 = 40

[redacted]

19. House numbers

20. In a knockout competition, every team except the winner is defeated once and once only, so the number of matches is one less than the number of teams in this case 23-1 = 22.

21. The answer is not zero degrees as you might at first think. The minute hand will be at 15 minutes (90 degrees clockwise from vertical) but the hour hand will have progressed to one quarter of the distance between 3 pm and 4 pm.

    Each hour represents 30 degrees (360 / 12), so one quarter of an hour equals 7.5 degrees, so the minute hand will be at 97.5 degrees: a 7.5 degree difference between the hands.

22. Put 2 bags to the side. Weigh 3 of the remaining bags against the other 3 remaining. If they weigh the same then weigh the 2 bags that you put aside to find out which of them is heavier. If, however, one of the sets of 3 bags was heavier, put one of the bags from the heavier set aside. Weigh the remaining two bags from the set to find out which one is heavier. If they are equal then you know that it is the 1 bag that you put aside.

23. Open the box that is labeled "Apples and Oranges".

    You know that since none of the labels are correct, the box must either contain only apples, or only oranges.

    Suppose that you remove an apple from that box. Therefore, that box must be the "Apples Only" box.

    One of the two remaining boxes must be the "Oranges Only" box.

    However, one is labeled "Apples Only", and the other is labeled "Oranges Only". Therefore, the one labeled "Apples Only" is the box that contains only oranges, and the box labeled "Oranges Only" is the box that contains both kinds of fruit.

24. **100**

25. 22: the minute hand will go round the dial 24 times, but the hour hand will also complete two circuits. 24 minus 2 equals **22**.

TYPICAL LOGICAL QUESTIONS INVOLVING SYSTEMATIC SERIES

Directions to Solve

In each series, look for the degree and direction of change between the numbers. In other words, do the numbers increase or decrease, and by how much

1. **Look at this series: 2, 1, (1/2), (1/4), ... What number should come next?**

(a) $\left(\frac{1}{3}\right)$ (b) $\left(\frac{1}{8}\right)$ (c) $\left(\frac{2}{8}\right)$ (d) $\left(\frac{1}{16}\right)$

ANSWER & EXPLANATION

Ans. (b)

Explanation: This is a simple division series; each number is one-half of the previous number.

In other terms to say, the number is divided by 2 successively to get the next result.

$$\frac{4}{2} = 2$$

$$\frac{2}{2} = 1$$

$$\frac{1}{2} = \frac{1}{2}$$

$$\left(\frac{\frac{1}{2}}{2}\right) = \frac{1}{4}$$

$$\left(\frac{\frac{1}{4}}{2}\right) = \frac{1}{8} \text{ and so on.}$$

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2. Look at this series: 7, 10, 8, 11, 9, 12, ... What number should come next?

(a) 7 (b) 10 (c) 12 (d) 13

Ans. (b)

Explanation: This is a simple alternating addition and subtraction series. In the first pattern, 3 is added; in the second, 2 is subtracted.

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3. Look at this series: 36, 34, 30, 28, 24, ... What number should come next?

(a) 20 (b) 22 (c) 23 (d) 26

Ans. (b)

Explanation: This is an alternating number subtraction series. First, 2 is subtracted, then 4, then 2, and so on.

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4. Look at this series: 22, 21, 23, 22, 24, 23, ... What number should come next?

(a) 22 (b) 24 (c) 25 (d) 26

Ans. (c)

Explanation: In this simple alternating subtraction and addition series; 1 is subtracted, then 2 is added, and so on.

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5. Look at this series: 53, 53, 40, 40, 27, 27, ... What number should come next?

(a) 12 (b) 14 (c) 27 (d) 53

Ans. (b)

Explanation: In this series, each number is repeated, then 13 is subtracted to arrive at the next number.

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16. **Look at this series: 21, 9, 21, 11, 21, 13, 21, ... What number should come next?**

(a) 14 (b) 15 (c) 21 (d) 23

Ans. (b)

Explanation: In this alternating repetition series, the random number 21 is interpolated every other number into an otherwise simple addition series that increases by 2, beginning with the number 9.

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Look carefully for the pattern, and then choose which pair of numbers comes next.

1. **28 25 5 21 18 5 14**

(a) 11 5 (b) 10 7 (c) 11 8 (d) 5 10 (e) 10 5

Ans. (a)

Explanation: This is an alternating subtraction series with the interpolation of a random number, 5, as every third number. In the subtraction series, 3 is subtracted, then 4, then 3, and so on.

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2. **8 11 21 15 18 21 22**

(a) 25 18 (b) 25 21 (c) 25 29 (d) 24 21

(e) 22 26

Ans. (b)

Explanation: This is an alternating addition series, with a random number, 21, interpolated as every third number. The addition series alternates between adding 3 and adding 4. The number 21 appears after each number arrived at by adding 3.

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3. **9 16 23 30 37 44 51**

(a) 59 66 (b) 56 62 (c) 58 66 (d) 58 65

(e) 54 61

Ans. (d)

Explanation: Here is a simple addition series, which begins with 9 and adds 7.

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4. **2 8 14 20 26 32 38**

(a) 2 46 (b) 44 50 (c) 42 48 (d) 40 42

(e) 32 26

Ans. (b)

Explanation: This is a simple addition series, which begins with 2 and adds 6. View Answer Workspace Report Discuss in Forum

5. **9 11 33 13 15 33 17**

(a) 19 33 (b) 33 35 (c) 33 19 (d) 15 33 (e) 19 21

Ans. (a)

Explanation: In this alternating repetition series, a random number, 33, is interpolated every third number into a simple addition series, in which each number increases by 2.

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In each of the following questions a number series is given with one term missing. Choose the correct alternative that will continue the same pattern and fill in the blank spaces.

1. 2, 7, 14, 23, ?, 47

(a) 31 (b) 28 (c) 34 (d) 38

Ans. (c)

Explanation: The given sequence is +5, +7, +9, ______.
i.e. 2 + 5 = 7, 7 + 7 = 14, 14 + 9 = 23
Missing Number = 23 + 11 =34.

2. 9, 12, 11, 14, 13, 7, 15

(a) 12 (b) 16 (c) 10 (d) 17

Ans. (a)

Alternatively, 3 is added and one is subtracted,

3. 1, 4, 9, 16, 25, ?

(a) 35 (b) 36 (c) 48 (d) 49

Ans. (b)

Explanation: The sequence is a series of squares, $1^2, 2^2, 3^2, 4^2, 5^2$....

4. 1, 4, 27, 16, ?, 36, 343

(a) 125 (b) 50 (c) 78 (d) 132

Ans. (a)

Explanation : The series consists of cubes of odd numbers and square of even numbers.

5. 13, 35, 57, 79, 911, ?

(a) 1145 (b) 1113 (c) 1117 (d) 1110

Ans. (b)

Explanation : The terms are formed by joining together consecutive odd numbers in order, i.e. 1 and 3, 3 and 5, 5 and 7, 7and 9, 9 and 11.....

6. Find the odd one out

(a) crusade (b) expedition (c) cruise (d) campaign

Ans. (c)

Explanation: Cruise = a sea voyage for pleasure. All other words are related to 'journey on land, sea with an aim'.

7. Find the odd one out

(a) flourish (b) renovate (c) blossom (d) thrive

Ans. (b)

Explanation: Renovate = to make new again, All other words are synonyms.

8. Find the odd one out

(a) Circle: Arc (b) Chair : Leg (c) Flower: Petal (d) Cover: Page

Ans. (d)

Explanation : In all other pairs, second is a part of the first.

ANALYTICAL REASONING

The phrase analytical reasoning is used by a lot of educational organizations as well as businesses. The phrase is used in direct relationship with recruitment, training and promotion. It often connotes the general aptitude of a person and his abilities to reason and find logical conclusions or solutions to given problems. It is often also suggestive of cognitive abilities of a person. But, what is the real meaning of analytical reasoning and how does one develop it or use it in the long run?

"It is elementary my dear Watson." One of the brightest fictional detectives of the last 150 years would often say this to his best friend. In an air that could best be tagged as arrogant, one of the **best analytical minds** ever to have been drafted by pen on paper, Sherlock Holmes, would often pour out his mind, analyzing cases and solving them before one could spell Hampstead Heath. His methods, which though were meaningful to him, had no apparent resemblance to reason or any established practice to others, who would often be left dumb-struck when the case would resolve right before their eyes. Sherlock Holmes, though a fictional character, is probably one of the better examples of an analytical mind, one who used the power of analytical reasoning to solve crimes.

Analytical reasoning comes from the ability of an individual to analyze a situation, think in a step by step method to evaluate the alternatives, eliminating the ones that don't fit the case, and finding a solution that best matches the problem at hand. A person gifted in analytical reasoning would be able to look through the problem, break it down to smaller problems and think in a multi-dimensional way. Another fundamental component of analytical reasoning is the ability to break down information at hand and find a pattern or trait in such information. Analytical reasoning capabilities of an individual are considered for the purpose of job interviews to select the right candidate for a position, in admission tests to educational programs and as well as for testing the general aptitude of a person in a wide variety of situations.

There is a misconception that analytical reasoning is something that one is born with. It is incorrect. Analytical reasoning can be taught and it needs to be practiced on a continuing basis for one to get better at it. Analytical reasoning is best practiced outside the classroom in real life situations but classroom tests revolving around set problems can give an individual a theoretical inception.

Uses of Analytical Reasoning Skills in Business and Education

Managers with excellent analytical reasoning abilities are generally considered as problem solvers. They are usually good with evaluating problems, analyzing them from more than one angle and finding a solution that works best in the given circumstances. Businesses look for managers who can be more than just leaders. They want their managers to employ analytical reasoning skills to meet challenges and threats and keep a business functioning smoothly. Usually the problems that a junior level manager may face can vary from simple technical problem at the factory floor to more complex labor unrests.

Even a SWOT analysis is considered as an avenue for the application of analytical reasoning capability of managers. SWOT means Strengths, Weaknesses, Opportunities and Threats. Together they create a framework, a guideline for any business decisions to be evaluated and tested before adoption. When junior managers take decisions on their own they have to ensure that their decisions conform to the guidelines that the business sets for every decision to satisfy. Being a fundamental yardstick for the measurement of every business decision, SWOT analysis involve the use of analytical reasoning skills to evaluate problems and then solve them.

The same way, educational institutions look for students who are good with not only their ability to use their knowledge in theoretical problem solving, inside a classroom, but also excellent in analytical reasoning, because at certain stage in their life they will need to face real life problems and at that point they should be able to figure out a solution for the same. This is why graduate level courses will require students to not only pass but have a certain grade in GRE tests.

Decentralization of the Decision-Making Process

Junior managers with good analytical thinking abilities can take the pressure off of their seniors in terms of day to day decision-making. Since these are the managers who are handling staff at the line level they are better prepared to deal with situations pertaining to it. Junior managers are expected to solve issues where their analytical reasoning skills are tested. Some business promote such independent handling to boost fresh thinking and give room to a junior manager to grow into a job.

There are two distinct process of thinking in problem solving. While the first one is analytical thinking the second one is critical thinking. They are used in different ways in problem solving and warrant different approaches altogether. While analytical thinking uses the information presented to break down the problem into a list of smaller challenges and finding a solution for the same, **critical thinking uses not only the data that is presented but as well use research methodologies to obtain additional information.** Analytical reasoning methods thus use a fact based reasoning to find a solution. On the other hand critical thinking uses a more fact finding type approach and finally come to a conclusion where whether or not a "statement or conclusion is correct or not is validated.

Honing Your Analytical Reasoning Skills

Being able to solve analytical reasoning questions is a pre-requisite to get admission to good graduate schools. If you have good scores in GRE you have a better chance of getting admitted to one of the top schools. There are a number of ways in which you could practice your analytical reasoning skills. One of the best ways to develop this skill is by practicing it against both real and fictional problems. A person with good analytical reasoning skills can see patterns and trends in the problem much easier than anyone else.

Books are probably the best source of test cases that are devised categorically for developing analytical reasoning skills. It is no wonder that people with good skills in mathematics, algebra and or geometry tend to have better analytical reasoning skills as well. **Mathematics forces a person to use more than one logical approach to solve a problem.** It is a basic requirement to viewing a problem from more than one angle. The same way, a person with good puzzle solving skills also have good analytical reasoning skills. In fact children are encouraged in primary schools to solve puzzles that develops their analytical thinking abilities.

Diagramming and Its Effectiveness in Solving Analytical Reasoning Tests:

If you are going to sit for a GRE test you need to have a clear understanding of how to **draw diagrams** in order to solve tests which are directed towards analyzing your analytical reasoning abilities. Very few people can actually play around such tests and or attempt to solve them without using some form of diagrams. Thus one of the critical requisites to hone your analytical reasoning skills is to practice drawing diagrams following the following three considerations.

There are three important considerations to perfectly draw diagrams that can help you solve analytical reasoning tests. You have to be (a) quick, (b) you need to be precise and last but not the least (c) your diagrams need to be easily understandable. Speed is the essence when it comes to drawing meaningful diagrams for solving reasoning tests. Keeping it simple and quick is a skill that is acquired only through practice so be prepared to spend hours honing your diagraming skills.

Let's say you have been given a problem where there are five key entities and several conditions to fulfill. Mr. Adams, Mr. Brian, Mr. Dwayne, Mr. Flintoff and Mr. Gerrard. They have to be seated in such a way that Mr. Adams and Mr. Flintoff are not seated beside each other and either Mr. Brian or Mr. Dwayne should be seated next to Mr. Gerrard. You are also given a condition that this is a round table. Additionally, you are told that after having the above conditions satisfied you will need to have them seated in the most logical alphabetical order. Without a diagram it would be difficult to find out the logical sitting positions that would satisfy all of the above conditions. While writing down the entities you should use the first letter of the names in capital. In the above example this would be A, B, D, F and G. You don't need to use additional letters as that will unnecessarily confuse you and complicate matters. Certain tests are given to confuse you deliberately. In the above example the names are given 'almost' in alphabetical order except that a name with C and E are missing. This is one of the things that you need to watch out for. Some students appearing for the exam will commit a mistake and include the alphabets C and or E in the list of entities while making the diagrams, which will make it incorrect.

HOW TO SOLVE |LEARN ANALYTICAL REASONING QUESTIONS IN TEST| QUIZ

- The term "analytic reasoning" refers to recognizing patterns and connections in a variety of information.
- Each analytical reasoning question is a logical puzzle, based on a given set of conditions.
- Analytical reasoning questions are presented in groups of four or five questions. Each group is based on a short passage followed by a set of conditions.
- Analytical Reasoning test measures your ability to analyze and to draw result from a complex situation by applying your logic.
- Analytical Reasoning questions are designed to assess the ability to consider a group of facts and rules, and, given those facts and rules, determine what could or must be true. The specific scenarios associated with these questions are usually unrelated to law, since they are intended to be accessible to a wide range of test takers. However, the skills tested parallel those involved in determining what could or must be the case given a set of regulations, the terms of a contract, or the facts of a legal case in relation to the law. In Analytical Reasoning questions, you are asked to reason deductively from a set of statements and rules or principles that describe relationships among persons, things, or events.

- Analytical Reasoning questions appear in sets, with each set based on a single passage. The passage used for each set of questions describes common ordering relationships or grouping relationships, or a combination of both types of relationships. Examples include scheduling employees for work shifts, assigning instructors to class sections, ordering tasks according to priority, and distributing grants for projects.
- Analytical Reasoning questions test a range of deductive reasoning skills. These include:
- Comprehending the basic structure of a set of relationships by determining a complete solution to die problem posed (for example, an acceptable seating arrangement of all six diplomats around a table)
- Reasoning with conditional ("if-then") statements and recognizing logically equivalent formulations of such statements.
- Inferring what could be true or must be true from given facts and rules.
- Inferring what could be true or must be true from given facts and rules together with new information in the form of an additional or substitute fact or rule.
- Recognizing when two statements are logically equivalent in context by identifying a condition or rule that could replace one of the original conditions while still resulting in the same possible outcomes

ANALYTICAL REASONING TYPES

- Seating Arrangements
- Combinations
- Selections
- Relations
- Sequencing
- Comparisons
- Ranking
- Grouping

Techniques used for Analytical problem solving

- Van Diagrams
- Line up representation
- Table representation
- Basic Linear Sequence Game set up
- If then Notation
- Grouping Game Diagrams
- Math Operators
- Equations
- Diagrams & Notations

MATH SYMBOLS

- And ∧
- OR ∨
- Not ~
- If, then ⊃
- Same as, Same age, same Seat, work Together =
- Not same, can not sit together, Can not work together ≠
- Greater than, older>
- At least ≥

- At most ≤
- Less than, younger<

Any good diagramming system must be:

- Fast – You must be able to express ideas in shorthand to save time
- Neat – messy notations will cost You points
- Easy to Understand – You must instantly understand what your notations mean

1. **Entities**

⏭ One of the first steps in setting up your diagram is write down a letter or number to represent each of your entities. Each game will have a list of entities that will be placed into an order or groups or both. Start by writing down this list of entities. For example; you are told that there are 5 different clogs in a race and they are a Labrador, Mixed Breed, Newfoundland, Poodle, and a Schauzer. Record this list of entities as follows:

- **L M N P S**

⏭ Notice that we only used one letter for Mixed Breed. There is no sense in confusing yourself with additional letters. Keep it to one letter per entity. Also notice that the entities are given in alphabetical order. However, they will often leave our a letter or two to confuse you. Some students will unwittingly insert that letter by force of habit. For example in this question many students might just add in the letter **O** because the are used to **O** following L M N. Make sure your list of entities matches those given.

⏭ Now that we have our list of entities we can move on to the diagram itself.

2. **Basic Linear Sequence Game set up**

⏭ A Linear Sequence Game will ask you to place a set of entities in order. This could be expressed in a number of ways including: 1st to 6th, First to Last, Monday to Friday, Top to Bottom, Front to Back, etc.

⏭ In order to make a place for each entity in your diagram simply lout an underline for each space where an entity will go. So if we are told to list five dogs in order from fastest to slowest we can set up our game as follows:

⏭ _____ _____ _____ _____ _____

⏭ We now have 5 spots for our 5 dogs. If you want you could put F and S at the ends of the diagram to represent that it goes from Fastest to Slowest. This is usually not necessary and can waste time when you are re-drawing your diagram. If you chose to include this extra notation make sure that the F and S do not match any of your entities. For example if you had a Schnauzer as one of your dog types you would not want to have S for Schauzer and S for slowest. One way you can avoid this is to put the f and s for fast and slow in lower case.

3. **Fixed Entity**

⏭ If we are told that an entity is placed in one spot then we can just fill that directly into the diagram. This is the easiest type of rule to include. For example if we are told that the Schnauzer will be 3rd fastest then we can include it as follows:

_____ _____ _____ _____ _____

S

⏭ Not in that spot: If we are told that a particular entity does not go in a particular spot we should add that directly to our diagram by putting the entity under that spot and designating that it does not go there. There are number of ways to designate that the entity does not go there. You can put a slash through it, or put — in front of the entity. Find one that works best for you. For example if we are told the Poodle is not the fastest dog we can include it in our diagram as follows:

tumbir_n24ogf5Pd×1sdq4z7o1_500.png

4. **Here or There Pair notation:**

⏭ This notation is used when two entities are going to fill two spots but we don't know which entity is in which spot. For example if K and T must be in spots 2 and 3. We know we either have K in 2 and T in 3 or T in 2 and K in 3.

⏭ The way to express this with the Here or There Pair notation is as follows:

tumbir_n24oqriTr51sdq4z7o1_500.png

5. **If then Notation**

⏭ Use an arrow = = = => for If then statements. Just rewrite the if then statement replacing If and then with = = = => arrows. Also remember to shorten the entity to the first letter.

⏭ For example the statement: if Albert is included then Bert is also included. Can be expressed as:

⏭ = = = => A = = = => B

6. **Spots between notation:**

⏭ If we are told that entities are a specific number of spots apart simply insert that many blank lines between them. For example: Two runners come after Sarah but before Fred. Can be expressed as

S ____ ____ F

⏭ This can be combined with the Here or There Pair notation.

Example: Two runners come between Sarah and Fred.

S/F ____ ____ F/S

Example 1:

7 persons live in a street, having houses in line; Consider the following:

1. A lives in the corner's house.
2. 2. C is between E and G 3.
3. There is 1 house between D and F 4.
4. F is neighbor of G s.
5. There are two houses between A and G

Solution:

7 Persons A, B, C, D, E, F, G

- 7 persons live in a street

We can make

X X X X X X X

1. A lives in the corner's house

So, there are two possibilities:

A X X X X X X

A X X X X X X
X X X X X X A

2. C is between E and G

Here, also two possibilities:

E C G
G C E

3. There is 1 house between **D** and **F** Two possibilities:

D X F
F X D

4. F is neighbor of G

2 possibilities

F G or G F

There are two houses between A and G

A X X G
G X X A

Two houses between **A** and **G**; A X X G
C is between **E** and **G**: A E C G
F is neighbor of **G**: A E C G F
1 house between **D** and **F** : A E C G F X D
And finally: A E C G F B D

TYPICAL QUESTIONS

Q.1. Each of the following could be true EXCEPT

(a) F is the heaviest.
(b) G is the heaviest.
(c) I is the heaviest.
(d) More than three athletes are heavier than K.
(e) More than three athletes are lighter than K

Ans. (e)

- As Maximum three athletes can be lighter than K
- **F > G > H > k > L > I > J OR G > F > H > k > L > I > J**

Q. 2. Which of the following, if true, would be sufficient to determine which athlete is the lightest?

(a) I is the heaviest
(b) I is lighter than K
(c) K is heavier than J
(d) J is heavier than K
(e) Exactly five students are lighter than F.

Ans. (d)

- If J is heavier than K then simply L will be the Lightest
- F > G > H > k > L OR G > F > H > k > L and I > J before K.

Q. 3. If J is heavier than F, how many different rankings by weight, of the athletes are possible?

(a) 1 (b) 2 (c) 3 (d) 4

(e) 5

Ans. **(d)**

- As F > G > H > k > L OR G > F > H > k > L & I > J > F
- If J > F then following relations can be possible
- I > J > F > G > H > k > L
- I > G > J > F > H > K > L
- G > I > J > F > H > K > L

Q. 4. If H is heavier than I, which of the following CANNOT be true?

(a) I's weight is equal to the average of F's weight and G's weight.

(b) I's weight is equal to the average of K's weight and L's weight

(c) J's weight is equal to the average of K's weight and L's weight

(d) J is the second lightest.

Ans. **(a)**

As H > I so possible relations can be

F > G > H > k > I > L > J OR G > F > H > I > k > J > L

PASSAGE BASED ANALYTICAL REASONING QUESTIONS

Read the paragraph carefully and determine the main point the author is trying to make. What conclusion can be drawn from the argument? Each paragraph is followed by five statements. One statement supports the author's argument better than the others do.

1. One New York publisher has estimated that 50,000 to 60,000 people in the United States want an anthology that includes the complete works of William Shakespeare. And what accounts for this renewed interest in Shakespeare? As scholars point out, his psychological insights into both male and female characters are amazing even today. This paragraph best supports the statement that

(a) Shakespeare's characters are more interesting than fictional characters today.

(b) People even today are interested in Shakespeare's work because of the characters

(c) Academic scholars are putting together an anthology of Shakespeare's work.

(d) New Yorkers have a renewed interested in the work of Shakespeare.

(e) Shakespeare was a psychiatrist as well as a playwright.

Ans. **(b)**

Explanation: The last sentence in the paragraph clearly gives support for the idea that the interest in Shakespeare is due to the development of his characters. Choice a is incorrect because the writer never makes this type of comparison. Choice c is wrong because even though scholars are mentioned in the paragraph, there is no indication that the scholars are compiling the anthology. Choice d is wrong because there is no support to show that most New Yorkers are interested in this work. There is no support for choice e either.

2. One of the warmest winters on record has put consumers in the mood to spend money. Spending is likely to be the strongest in thirteen years. During the month of February, sales of existing single-family homes hit an annual record rate of 4.75 million. This paragraph best supports the statement that
   (a) Consumer spending will be higher thirteen years from now than it is today.
   (b) More people buy houses in the month of February than in any other month.
   (c) During the winter months, the prices of single-family homes are the lowest.
   (d) There were about 4 million homes for sale during the month of February.
   (e) Warm winter weather is likely to affect the rate of home sales.

Ans. (e)

Explanation: This is clearly the best answer because the paragraph directly states that warm weather affects consumers inclination to spend. It furthers states that the sales of single-family homes was at an all-time high. There is no support for choice a or c. Choice b is wrong because even though there were high sales for a particular February, this does not mean that sales are not higher in other months. Choice d presents a misleading figure of 4 million. The paragraph states that the record of 4.75 million was at an annual, not a monthly, rate.

3. Generation Xers are those people born roughly between 1965 and 1981. As employees,

   Generation Xers tend to be more challenged when they can carry out tasks independently. This makes Generation Xers the most entrepreneurial generation in history. This paragraph best supports the statement that Generation Xers
   (a) Work harder than people from other generations.
   (b) Have a tendency to be self-directed workers
   (c) Have an interest in making history
   (d) Tend to work in jobs that require risk-taking behavior
   (e) Like to challenge their bosses work attitudes.

Ans. (b)

Explanation: The support for choice b is given in the second sentence of the paragraph. Generation Xers like to work independently, which means they are self-directed. No support is given for either choice a or choice c. Choice d is not related to the paragraph. Although the paragraph mentions that Generation Xers like to be challenged, it does not say they like to challenge their bosses attitudes; therefore, choice e can be ruled out.

4. If you're a fitness walker, there is no need for a commute to a health club. Your neighborhood can be your health club. You don't need a lot of fancy equipment to get a good workout either. All you need is a well-designed pair of athletic shoes. This paragraph best supports the statement that
   (a) Low-fat ice cream produces more revenue than other low-fat foods.
   (b) Ice cream store owners would be better off carrying only low-fat ice cream
   (c) Ice cream store owners no longer think that low-fat ice cream is an unpopular item
   (d) Low-fat ice-cream is more popular than other kinds of ice cream.
   (e) Consumers are fickle and it is impossible to please them.

Ans. (c)

Explanation: This choice is supported as the best answer because the paragraph indicates that low-fat ice cream was once an unpopular item, but now, because consumers are more health conscious and because there is a wider array of tasty low-fat foods, low-fat ice cream is a profitable item for ice cream store owners. There is no indication that choices a, b, d, or e are true based on the information given.

5. Today's high school students spend too much time thinking about trivial and distracting matters such as fashion. Additionally, they often dress inappropriately on school grounds. Rather than spending time writing another detailed dress policy, we should make school uniforms mandatory. If students were required to wear uniforms, it would increase a sense of community and harmony in our schools and it would instill a sense of discipline in our students. Another positive effect would be that teachers and administrators would no longer have to act as clothing police, freeing them up to focus on more important issues. This paragraph best supports the statement that

(a) Inappropriate clothing leads to failing grades.
(b) Students who wear school uniforms get into better colleges.
(c) Teachers and administrators spend at least 25% of their time enforcing the dress code.
(d) Students are not interested in being part of a community.
(e) School uniforms should be compulsory for high school students

Ans. (e)

Explanation: The support for choice e is in the third sentence "we should make school uniforms mandatory". There is no evidence provided to support choices a, b, and d. And although we know that teachers and administrators are spending some of their time enforcing dress code, the paragraph does not quantify how much of their time is spent that way, so there is no support for choice c.

6. The criminal justice system needs to change. The system could be more just if it allowed victims the opportunity to confront the person who has harmed them. Also, mediation between victims and their offenders would give the offenders a chance to apologize for the harm they have done. This paragraph best supports the statement that victims of a crime should.

(a) Learn to forgive their offenders.
(b) Have the right to confront their offenders.
(c) Learn the art of mediation.
(d) Insist that their offenders be punished.
(e) Have the right to impose a sentence on their offenders.

Ans. (b)

Explanation: This answer is clearly stated in the first sentence of the paragraph. There is no support in the passage for choices a, d, or e. As for choice c, although mediation is mentioned, the statement does not indicate that victims should be the mediators.

7. A few states in this country are considering legislation that would prohibit schools from using calculators before the sixth grade. Other states take a different position.

Some states are insisting on the purchase of graphing calculators for every student in middle school. This paragraph best supports the statement that in this country.

(a) There are at least two opinions about the use of calculators in schools.
(b) Calculators are frequently a detriment to learning math.
(c) State legislators are more involved in education than ever before.
(d) The price of graphing calculators is less when schools buy in bulk.
(e) The argument against calculators in schools is unfounded.

Ans. (a)

Explanation: The paragraph clearly states that there are two differing opinions with regard to the use of calculators in the classroom. Although some people may believe that choice b is true, the paragraph does not indicate this. Choice c has no relation to the paragraph. Choice d makes logical sense, but the paragraph says nothing about cost. Choice e is an opinion that is not given in the paragraph

8. Today's workforce has a new set of social values. Ten years ago, a manager who was offered a promotion in a distant city would not have questioned the move. Today, a manager in that same situation might choose family happiness instead of career advancement. This paragraph best supports the statement that

(a) Most managers are not loyal to the corporations for which they work.
(b) Businesses today do not understand their employee's needs
(c) Employees social values have changed over the past ten years
(d) Career advancement is not important to today's business managers
(e) Companies should require their employees to accept promotions.

Ans. (c)

Explanation: A change in employee social values over the past ten years is implied in the whole paragraph, but particularly in the first sentence. Choice a is incorrect because the loyalty of the managers to their corporations is never discussed. There is no support for choice b. In choice d, perhaps career advancement is less important than it once was, but the paragraph does not indicate that advancement is unimportant to managers. Choice e is an opinion that is not supported.

9. It is well-known that the world urgently needs adequate distribution of food, so that everyone gets enough. Adequate distribution of medicine is just as urgent. Medical expertise and medical supplies need to be redistributed throughout the world so that people in emerging nations will have proper medical care. This paragraph best supports the statement that

(a) The majority of the people in the world have never been seen by a doctor.
(b) Food production in emerging nations has slowed during the past several years.
(c) Most of the world's doctors are selfish about giving time and money to the poors.
(d) The medical-supply industry should step up production of its products.
(e) Many people who live in emerging nations are not receiving proper medical care.

Ans. (e)

Explanation: This answer is implied by the statement that redistribution is needed so that people in emerging nations can have proper medical care. Choices a, b, and c are not mentioned in the passage. Choice d is also incorrect â€" the passage indicates that the distribution of medicine, not its production, is inadequate.

MCQsON LOGICAL REASONING & ANALYTICAL ABILITY

(1)

QUESTIONS AND STATEMENTS

In such type of test, a question is given followed by two statements. You have to find out that which statements is/are sufficient to answer the question?

Example—Question—Who is brother of B?

(a) B is brother of A.

(b) B's father is husband of A's mother.

Give Answer

(a) If only statement I is sufficient to answer the question.

(b) If only statement II is sufficient to answer the question.

(c) If either I or II alone is sufficient to answer the question.

(d) If both statements I and II are not sufficient to answer the question.

(e) If both statements I and II are sufficient to answer the question.

Answer with Explanation (D)—From the statement I, B is brother of A hence A may be brother of B and A may be sister of B. Therefore, statement I is not sufficient to answer the question from the statement II, B's father is husband of A's mother. Hence, A and B are the children of single parents, but it is not certain that A is daughter or son. Therefore, statement II is also not sufficient to answer the question.

Beside this if we combine both the statements, still there is no answer for the question. Therefore, option 'D' is our answer.

EXERCISE

Directions (Q. 1-26). Each question consists of two statements I and II given below it. You have to find out all possible combinations which could be sufficient for answering a question. Read both the statements:

Give Answer

(a) If only statement I is sufficient to answer the question

(b) If only statement II is sufficient to answer the question.

(c) If either I or II alone is sufficient t answer the question.

(d) If both the statements I and II are sufficient to answer the question.

(e) If both the statements I and II are not sufficient to answer the question.

MCQs

1. **In our school how many students of class V are there, who play chess?**
   (a) No girl likes to play chess.
   (b) There are 40 students in Class V.
2. **Raza is 10th student in the class. How many students are in class?**
   (a) His friends ranks 58 in that class which is the last rank.
   (b) Raza ranks 49th from the opposite end (another end).
3. **What is Akbar's age?**
   (a) Akbar could not appear in the last examination. He is two months short than the required age which is 18 years.
   (b) He will be able to cast his vote this year and the minimum age for voting is 18 years.
4. **How many brothers does Ashraf have?**
   (a) Ashraf's father has three children.
   (b) Ashraf has two sisters.
5. **Who is the tallest in five friends?**
   (a) D is taller than A and C.
   (b) B is shorter than E but taller than D.
6. **At what time did the train depart?**
   (a) Generally the train departs at right time.
   (b) The scheduled departure time is 14:30.
7. **When will be Chandra's birthday this year?**
   (a) It occurs between 11 and 13 February. (Thursday occurs on 11 February)
   (b) It does not occur on Saturday.
8. **How many students of science got more than 60% marks?**
   (a) 35% from all the students got 60% marks.
   (b) The students who got 60% marks are 55% from science.
9. **How many matches will be played between A and B in this competition?**
   (a) A has already won 3 matches against B. Simultaneously it has also won the competition after winning 3rd match.
   (b) Fifth match will be played next week.
10. **What is relation between D and A?**
    (a) B is brother of A. (b) B is son of D.
11. **How many times is Raza heavier than Viqas?**
    (a) Viqas's weight is 65 kilogram.
    (b) Anwar's weight is 10 kg more than Raza's weight.
12. **In which year was Raza born?**
    (a) In 1989 Raza's mother was 44 years old.
    (b) Raza was born 3 years after his mother's marriage.

13. **In the game of playing cards there are four members, who is C's partner?**
    (a) D is sitting opposite to A.
    (b) B is sitting in the right of A and in the left of C.

14. **On which day of January Sarfraz departed to Germany?**
    (a) Sarfraz has passed 10 years in Germany till now.
    (b) Sarfraz's friend Aamir departed to Germany on 15 Feb. and he accompanied Sarfraz 20 days after Sarfraz's arrival.

15. **On which day Ali met an accident?**
    (a) Ali left hospital on Saturday 3 days after the accident.
    (b) Ali was going on Scooter on Monday.

16. **How long did a man travel on a particular day?**
    (a) His average was 160km/ day in last 10 days.
    (b) He walked 8 hours with an average speed of 20 kms.

17. **A, B and C left a cinema hall and they forgot the bag. Who forgot the bag there?**
    (a) When they were entering into the cinema hall B did not have any bag.
    (b) C had his own bag when they came out from the cinema hall.

18. **Of three buildings, which is the lowest?**
    (a) All buildings follow the rules formed by the corporation.
    (b) Of these two buildings have similar height.

19. **What is the weight of a person?**
    (a) If the weight of this person is not included the average weight of the group decreases 2 kg while their average weight was 30 kg.
    (b) The weight of this person and his friend is 87 kg.

20. **How many cubes of ice can pervade in a vessel whose capacity is 80 C.C.?**
    (a) The length, width and height of ice cube is 1/2 cm.
    (b) 640 cubes of ice occupy 320 C.C.

21. **What was the total sale of the company?**
    (a) The company sold 8000 pieces to A @ 257- per piece.
    (b) This company does not manufacture any other product.

22. **What is the quantity of the exported rose apple of Jhandoba?**
    (a) 80,000 ton of Jamun has been exported to America from Jhandoba which is 10% of the total export of Jamun.
    (b) The export of Jamun is 12.5% against the targeted export i.9 ton from Jhandoba.

23. **Which will be 14th day of a month?**
    (a) The last day of that month is Wednesday
    (b) The third Saturday of that month fell on 17th.

24. **Is Akram capable to get entrance in a company?**
    (a) Company does not permit the entrance of any un-known person.
    (b) All the workers are capable to get entrance.

25. **Why did Pakistani Scientists not progress in any field?**
    (a) Pakistani Scientists did not get the facilities for advanced scientific experiments.
    (b) Pakistani Scientists think that the knowledge of western scientific progress is sufficient for the progress of any country.

26. **Does coffee drinking cause the headache?**
    (a) The stimulating of pan crease causes headache.
    (b) Coffee contains caffein which stimulates pancrease much

Directions (Q. 27-29) In the followings each question followed by two statements I and II are given. You have to ascertain that the information given in the statements is sufficient or not. Read carefully both the statements and answer.

(a) If the information given in statement I is sufficient to answer the question whereas the information given in statement II is not sufficient to answer the question.

(b) If the information given in the statement II is sufficient to answer the question whereas the information given in the statement I is not sufficient to answer the question.

(c) If either the information given in the statements I or in II is not sufficient to answer the question.

(d) If both the information given in the statements I and II are not sufficient to answer the question.

(e) If both the information given in the statements I and II are sufficient to answer the question.

27. **Who teaches History from P, Q, R, S & T?**
    (a) From them, each teaches only one subject. Q teaches Maths whereas T Teaches Science. P or R does not teach Geography. S or P does not teach English.
    (b) T and R are the teachers of Science and English. P is the teacher of Maths.

28. **Among the six friends A, B, C, D, E and F who got the maximum marks?**
    (a) B got fewer marks than A and F but not fewer than C, and E.
    (b) F did not get more marks than B but not as A.

29. **What will be the position of hour's hand in the clock at 7.30 P.M.?**
    (a) English alphabets are placed in the dial of clock in place of number.
    (b) The position of hour's hand is on P at 7 P.M.

Direction (30-33): In each of the following given questions there is a question followed by two statements (a) and (b) which are given. You have to find out that the information given in the statements is sufficient to answer or not. Read both the statements.

Give Answer:

(a) If only Statement I is sufficient to answer the question.

(b) If only Statement II is sufficient to answer the question.

(c) If either I or II alone is sufficient to answer the question.

(d) If both the Statements I and II are sufficient to answer the question.

(e) If both the Statements I and II are not sufficient to answer the question.

30. What is the meaning of 'come' in a coded language?

(a) The meaning of 'pit na ja' is 'come and go' in that coded language.

(b) The meaning of 'na dik sa' is 'you may go' in that coded language

31. What does the relation P have with M?

(a) P is brother of K and T.

(b) T is daughter of Q and sister of M's daughter.

32. Who is the tallest amongst M, T, R, K and Q?

(a) T is taller man R, M and Q but shorter than K.

(b) R is shorter than T and M but taller than Q.

33. In which direction is D from P?

(a) S is in the South from P which is in the West of D.

(b) P and R is in a straight line and R is in the South from D.

ANSWERS WITH EXPLANATION

1. (d) Both the statements can not derive any conclusion.

2. (b) According to II statement, the number of all the students is

$$= (10 + 49) - 1$$
$$= 58$$

3. (a) Akbar's age = 17 years 10 months.

4. (e) Ashraf's father has three children in which; are sisters. Clearly, Akbar is the only son in the family. Thus, we can say, Akbar has no brother.

5. (e)

6. (d) From the Statement I, train generally leaves at the right time but it is not clear that the train always leaves at right time. It might be possible that the train would not have left at right time. Hence, Statement II is not sufficient to answer

7. (a) From the Statement I, clearly, it is 12 February.

8. (d)

9. (e)

10. (d) From the Statements, it is not mentioned 10 that A and D are male or female.

11. (d) There is no relation among Raza and Wiqas's weight.

12. (d) 'In which year, Raza's mother was married, it is not clear.

13. (c)

14. (d)

15. (a)

16. (b)

17. (e)

18. (d)

19. (a) The average weight of 21 persons including the new person

$$= 30 \text{ kg}$$

Total weight $= 21 \times 30$

$$= 620 \text{ kg}$$

Average weight of 20 persons excluding the new person = 30 kg.

Total weight: = 21 × 30 = 620kg

(c)

20. (e)

21. (c)

22. (b)

23. (d)

24. (a)

25. (e)

26. (a)

27. From Statement

P — History

Q — Mathematics

R — English

S — Geography

T — Science

Hence, History is taught by P.

From Statement II

History is taught either by Q or R, hence, the information given in Statement I is sufficient to answer.

28. From Statement I

A & F > B < C, D and E

From Statement II,

A > F > B

From both the Statements I and II

A > B >C, D and E

Hence, it is clear with both the statements that A got maximum marks.

29. (d) By placing letter in place of number in the clock.

1 → A, 2 → B, 3. → C, 4. D, 5 → E, 6 → F,

7 → G, 8 → H, 9 → I, 10 → J, 11 → K, 12 → L

Hence, it is clear that the position of hand of the clock between 7 and 8, or G and H, but the G and H are imaginary letters, therefore, no inference can be drawn by the Statement

30. (d) From Statement II

'na' ——→ g

From 1, 9 ——→ either 'pit, or ja'

But here, no letter is given for 8, hence we cannot determine.

31. (e) From the Statement II, T is M's daughter's sister means T is M's Doctor

From the Statement I,

P is T's brother;

∴ therefore, P is M's son

32. (c) From Statement I, T is taller than R, M and Q, but shorter than K.

∴ K is the tallest

From Statement II R, T and M are shorter than K but taller than Q.

Hence, K is the tallest.

33. (a) From the Statement I, S is in South of P and P is in West of D.

Hence, D is East of P.

(2)

STATEMENT AND CONCLUSION

In such type of test, a statement is given followed by its four conclusions. The candidate is required to find out the correct conclusion, whether it might be wrong.

Example:

Statement: Some of the football players are not the teacher of the college.

Conclusion

(a) No football player is a teacher of the college

(b) Some teachers of the college may be football players

(c) Some players of the college may be teachers

(d) Saleem who plays the chess, cannot be teacher of the college

Answer with Explanation (b): If some teachers of the college are not football players the remaining teachers of the college may be football players. Hence, option (b) is correct answer.

EXERCISE 1

Directions (Q. 1-7): A statement is given in each of the following questions and it is followed by its four alternatives in which one alternative either support or refute the statement. Find out the alternative from each question.

1. **United States of America always favour Israel.**

Conclusions:

(a) The headquarter of UNO is in United States of America

(b) Jewish Lobby in U.S.A. is very powerful

(c) United States of America agreed to form a committee to investigate the assassination of 18 Palestinians by Israel's soldiers

(d) Israel is capable to defend itself

2. **Industrial development promotes the chances of employment.**

(a) Recession causes unemployment

(b) The purchasing power of a person decreases on account of unemployment

(c) Unemployment causes recession

(d) The life of the people who live in the developed countries is better than that of less developed countries

3. **Scientists are the biggest enemy of mankind.**

(a) They have invented many harmful medicines

(b) They have invented many destructive weapons

(c) They were unable to prepare a healthy environment for all

(d) They are serving only for the interest of rich nations

4. **The family planning programme in Pakistan has partly succeeded.**
   (a) The population growth rate in Pakistan is still very high
   (b) In rural areas, there is no arrangement for proper health-care
   (c) The media of Telecommunication are not playing their roles to carry out the messages effectively
   (d) The criticism of limited family is restricted by our religious belief

5. **In some society there is a very much prejudice against a female infant.**
   (a) Males are physically stronger than females
   (b) Male infants are supposed to bring prosperity in the family
   (c) Muslim Society is paternal in nature
   (d) Various methods are being used to detest and abort a female infant in our society

6. **Using too much time in T.V. viewing affects on eye-sight. Which of the following four alternatives is true?**
   (a) T.V. viewing is a wastage of time and energy as well and one can feel fatigue or tiredness if one watches for a longer period
   (b) If one watches T.V. in a bad posture, it affects one's eye-sight
   (c) The persons who have problems with their eye-sight should not watch T.V. programmes
   (d) 60% of the eye's problems are caused by T.V. watching for a longer period

7. **To succeed in examination one should work hard. Which of the given four conclusions is true?**
   (a) Those who work hard always get success
   (b) Examination is closely related with hard work
   (c) No one can get success without hard work
   (d) One who does hard work, always satisfies

Directions (Q. 8-17): In each of the following questions a statement is given and it is followed by its four conclusions A, B, C and D. Find out the conclusion which is correctly derived from the statement.

8. **Soldiers serve their country.**
   (a) Those who serve their country are soldiers
   (b) Women do not serve their country because they are not soldiers
   (c) Generally, men serve their country
   (d) Some men, who are soldiers, serve their country

9. **Most of the students are talented.**
   (a) Some students are talented
   (b) No students are there who are not talented
   (c) Some of the students are those who have low standard
   (d) All students are talented

10. **Most of the pens of that shop are costly.**
   (a) There are no cheap pens in that shop

(b) Some pens are costly in that shop
(c) Some pens are cheap in that shop
(d) Raja pens are costly in that shop

11. If a person is a rich, he is very influential.

(a) John has much influence, therefore, he is rich
(b) If a person is not rich, he has no influence
(c) Kasim is a rich so he is very influential person
(d) Poor persons have no influence

12. Smokers are affected by cancer.

(a) Many of the cancer patients are smokers
(b) Smoking may cause cancer
(c) Most of the smokers may be affected by cancer
(d) Smoking always causes cancer

13. The book which I read yesterday, was the best.

(a) The other books which I read, were not excellent
(b) The book which I read yesterday, was the best book among all the books that I have ever read
(c) The book of yesterday was as good as other books
(d) The book of yesterday was excellent

14. Some leaders are corrupt as Akram.

(a) Akram is not corrupt (b) Leaders are not corrupt
(c) Akram never be a corrupt (d) Some leaders are corrupt

15. Statement—Television assures its viewers that they may fall prey to some criminal activity and simultaneously, it is urged T.V. viewers that they should bear the happening silently.

The above-mentioned statement may furnish one of the following conclusions:

(a) People should not watch T.V. Programme:
(b) Television intensifies the insecurity feeling among its viewers
(c) T.V. viewers are more prone to prey in criminal activities in comparison to other people
(d) T.V. viewing is responsible for enhancing of criminal inclination

16. Ignorance is much delighted.

I. Knowledge is unnecessary.
II. Ignorant people are lucky.

(a) Only I (b) Only II
(c) Both I and II (d) Neither I nor II

17. Fortune favours the brave.

I. The people who endanger themselves are more successful.
II. Coward can never be a lucky.

(a) Only I (b) Only II (c) Both I & II (d) Neither I nor II

ANSWERS WITH EXPLANATION

1. (c) U.S.A. endorsed the formation of a committee for the investigation into the death of 18 Palestinians by the soldiers of Israel. It indicates that U.S.A. does not always favour Israel.

2. (d) The living standard of a person in a country depends upon his employment. If a country is developing, the opportunities for the employment will increase. Hence, the fourth alternative confirms the statement.

3. (b) The second alternative confirms the statement that the scientists are the biggest enemy of mankind because they have invented deadly destructive weapons.

4. (a) The population growth in Pakistan is still very high! Hence, the statement that the family planning programme in Pakistan has partly succeeded is true.

5. (b) It is prevalent in some society that male child extends the family and he enhances the Wealth and prosperity. Hence, second alternative confirms the statement.

6.	(d)	7.	(c)	8.	(d)	9.	(c)	10.	(c)	11.	(c)	12.	(c)
13.	(b)	14.	(d)	15.	(c)	16.	(b)	17.	(a)				

Type II

In such type of questions, a statement is given followed by two conclusions. The candidate is required to deduce the conclusion based upon this statement. If the conclusion (a) is correct, the answer will be (a) and the conclusion in (b) is correct, the answer will be (b) If both the conclusions are correct, the answer will be C and if (a) is correct and (b) wrong and (b) is correct (a) wrong, the answer will be (d). If there is no conclusion following the answer will be (e).

Example:

Statement—If you are a refined artist, we have a right job for you to prove your worth.

Conclusions:

(i) You are a refined artist. (ii) We are a refined artist.

(a) 1 (b) 2 (c) 3. (d) 4 (e) 5

Answer with Explanation (b)—In the given statement the word 'If' is given which cannot confirm that you are a refined artist. Hence, the first conclusion cannot be followed by the statement. But it is given in the statement, if you are a refined artist and we have a right job to prove your worth. It is clear that we have a requirement of a refined artist. Thus, the second conclusion confirms the statement.

EXERCISE 2

Directions (Q. 1-15): In each of following questions a statement is given followed by two conclusions.

Give answer:

(a) If only conclusion I follows, (b) If only conclusion II follows,
(c) If either nor II follows, (d) If neither I nor II follows and

(e) If both I and II follow.

1. **Company X has marketed the product, go ahead to purchase if its price and quality are in your consideration.**

Conclusions:

(a) The product must be good in quality.
(b) The price of the product must be reasonable.

2. **Vegetables prices are soaring in the market.**

(a) Vegetables are becoming a rare commodity.
(b) People cannot eat vegetables.

3. **This world is neither good nor evil, each man manufactures a world for himself.**

(a) Some people find this world quite good.
(b) Some people find this world quite bad.

4. **Our security investments carry market risk. Consult your investment advisor or agent before investing.**

(a) One should not invest in securities.
(b) The investment advisor calculates the market risk with certainty.

5. **Today out of the world population of several thousand millions the majority of men have to live under Governments which refuse them personal liberty and the right of dissent.**

(a) People are indifferent to personal liberty and right to dissent.
(b) People desire personal liberty and right to dissent.

6. **In diabetes, there is an excess of sugar in the body. Our body needs sugar for energy, the quantity of sugar in excess of body's requirement is excreted through urine.**

(a) The excessive consumption of sugar is likely to lead to diabetes.
(b) Consumption of sugar should be avoided.

7. **Good voice is a natural gift but one has to keep practising to improve and excel in the field of music.**

(a) Natural gifts need nurturing and care.
(b) Even though your voice is not good, one keep practising.

8. **All the organised persons find time for rest. Sana in spite of her very busy schedule, finds time for rest.**

(a) Sana is an organised person.
(b) Sana is an industrious person.

9. **Jade plant has thick leaves, it requires little water**

(a) All plants with thick leaves require little water.
(b) Jade plants may be grown in places where water is not in abundance.

10. **Until your country achieves economic equality, political freedom and democracy would be meaningless.**

(a) Political freedom and democracy go hand in hand.
(b) Economic equality leads to real political freedom and democracy.

11. **In case of outstanding candidates, the condition of previous experience of social work may be waived by the Admission Committee for M.A. (Social Work).**
    (a) Some of the students for M.A. (Social Work) will have previous experience of social work.
    (b) Some of the students for M.A. (Social Work) will not have previous experience of social work.

12. **Water supply in wards A and B; of the city will be affected about 50% on Friday because repairing work of main lines is to be carried out.**
    (a) The residents in these wards should economise on water on Friday.
    (b) These residents in these wards should store some water on the previous day.

13. **The government of country X has recently announced several concessions and offered attractive package tours for foreign visitors.**
    (a) Now, more number of foreign tourists will visit the country
    (b) The government of country X seems to be serious in attracting tourists.

14. **From the next academic year, students will have the option of dropping Mathematics and Science for them school leaving certificate examination.**
    (a) Students who are weak in Science and Mathematics will be admitted.
    (b) Earlier students did not have the choice of continuing their education without taking these subjects.

15. **Industrial revolution which first of all started has brought about modern age.**
    (a) Disparity between rich and poor results in revolution.
    (b) Revolution overhauls society.

ANSWERS WITH EXPLANATION

1. (e) It has been mentioned in the statement that the person who considers price as well as quality before buying a product should buy the product of company X. Hence, both I and II follow.

2. (d) In the given I Statement, the availability of vegetables is not mentioned. So, I does not follow. For the conclusion II, it is not directly related to the statement and so it also does not follow.

3. (e) In the given statement, it has been mentioned that the world for a man is as he made it himself. So, we can say that some people might find it good, and some quite bad. Hence, both I & II follow.

4. (b) The investment consultants are well acquainted with the market risks. Hence, it has been suggested that one should consult them before investing one's money in securities.

5. (b) It is obvious from the given statement that people desire personal liberty and right to dissent.

6. (a) It is not advisable for avoiding consumption of sugar is not the right approach to avoid diabetes. So. conclusion II does not follow. However in the context of the statement conclusion I follows as excessive sugar is the most likely cause of diabetes.

7. (a) It is clear that conclusion I follows directly from the statement. But, II is not related to the given statement and so it does

8. (e) Saleem has a very busy schedule. It denotes that he is an industrious but still she spares time for rest. This shows that he is an organised person. Hence, both I and II follow.

9. (b) The given statement talks of jade plants only and not all plants with thick leaves. It, therefore I does not follow? Also, since Jade plants require little water, so they can be grown in the area where water is not in abundance. Hence, II follows.

10. (b) There is nothing mentioned about the relation between political freedom and democracy in the statement. Hence, (a) does not follow. In case of conclusion (b), it is directly followed from the given statement.

11. (e) With the given statement, previous experience is an essential condition for candidates for outstanding candidates, this condition can be waived. It shows that some candidates will have previous experience while some will not.

12. (e) Clearly, the information has been given before hand in order that the residents of that area can collect and store water on the previous day and use less water on Friday. Thus, both (a) and (b) follow.

13. (e) It is clear from both the statements that the government has taken the step to attract more tourists. Hence, both (a) and (b) follow.

14. (e) The new system provides the students the choice of dropping Science and Mathematics so weak students of these subjects can also be admitted. Hence, (a) follows. Also, it is mentioned that the new system will come in force from the forthcoming academic year. It shows that this system was not prevalent earlier. Hence, (b) also follows.

15. (b) The cause of revolution cannot be deduced from the statement. It, therefore (a) does not follow but the statement describes that Industrial Revolution brought about modern age. It means that revolution society. Hence, conclusion (b) follow.

(3)

PASSAGE

In such type of questions, a passage is given which is usually a part of report or an economic essay or any other similar thought-provoking topic or subject some inferences are given followed by the passage. Generally, there are five inferences the candidate is asked to decide whether the given inference follows or not in the context of the passage.

The pattern of the passage is given below:

Directions: Given below a passage followed by five inferences based on it. The candidate has to examine the passage carefully and then decide the validity of the each inference. **Mark Answer:**

(a) if the inference is 'definitely true' *i.e.*, it properly follows from the statement of facts given.

(b) if the inference is 'probably true' though not 'definitely true' in the light of the facts given.

(c) if the data are inadequate *i.e.*, from the facts given you cannot say whether the inference is likely to be true or false.

(d) if the inference is 'probably false' though not 'definitely false' in the light of the facts given.

(e) if the inference is 'definitely false' *i.e.*, it cannot possibly be drawn from the facts given or it contradicts the given facts.

We can solve the passage in three steps:

(i) Directly follows from the given passage.

(ii) Can be inferred from the given passage.

(iii) Can be inferred with the help of some key words in the given passage.

In the first step try the easy questions where an inference is more or less a restatement of some thing which is already stated in the passage. In the second step we check if the inference can be derive from the facts mentioned in the passage and in the third if step, we see if some key words justify the given inference.

Example of Passage: The immediate challenge is on the food front. Shortfalls in production have been allowed to affect supplies and hence prices. The Government is planning to focus on investment in irrigation and even revival of agricultural extension system what is probably needed is a fresh dose of Green Revolution strategy. It appears that the Green Revolution instruments to encourage farmers to invest are no longer effective. The Green Revolution strategy was based on the state taking out the risk of collapse in prices. Farmers were offered remunerative prices and a guaranteed procurement of their produce in case the open market could not absorb it. Farmers could then borrow from banks, acquire the Green Revolution Technology and produce as much as they could. The pressure on the food subsidy was manageable as long as there was a food shortage. Prices in the open market then tended to be above the procurement prices. But with the food surpluses the situation has changed. The situation was unsustainable not merely because of the magnitude of this subsidy. It was also inefficient. It meant farmers were being led to produce crops based just on the prices Government fixed and not in relation to any real demand. In these circumstances, the Government was reluctant to keep increasing procurement prices' at the pace that used to be the norm in earlier years.

1. The Government is planning to make crucial changes in the Green Revolution strategies.
2. The Government is no longer in a position to provide subsidy to farmers.
3. As the open market prices are lower, all the burden of procurement of crops in on the Government.
4. Demand is much higher than the quantity of crops produced by the farmers.
5. The farmers tend to produce the crops as per their convenience and not consonant with the demand.

ANSWERS WITH EXPLANATION

1. (b) The statement is probably true though not definitely true in the light of the facts given as according to the passage. "The Government is planning to focus on investment in irrigation and revival of agriculture extension which is probably needed in green revolution strategies."

2. (c) Nothing is said about it in the passage so the data are inadequate".

3. (a) The given statement is definitely true as it is given in the passage that the farmers were offered remunerative prices and a guaranteed procurement of their produce in case the open market could not absorb it.

4. (e) The given statement is definitely true because it is mentioned in the passage that the farmer were being led to produce crops based just on the prices government fixed and not in relation to any real demand.

EXERCISE

Directions (Q. 1-5): Below given a passage followed by several possible inferences which can be drawn from the facts stated in the passage. You have to examine each inference separately in the context of the passage and decide upon its degree of truth or falsity.

Mark Answer:

(a) If the inference is 'definitely true' i.e., it properly follows from the statement of facts given.

(b) If the inference is 'probably true' though not 'definitely true' in the light of the facts given.

(c) If the 'data are inadequate', i.e. from the facts given you cannot say whether the inference is likely to be true or false.

(d) If the inference is 'probably false', though not 'definitely false' in the light of the facts given.

(e) If the inference is 'definitely false', i.e. it cannot possibly be drawn from the facts given or it contradicts the given facts.

Growth through acquisitions and alliances has become a critical part of creating value for pharma and biotech manufacturers and their shareholders. However, companies and their investors may risk value destruction if they acquire rights to a drug that suddenly poses unanticipated safety risks for patients. Similarly, safety related compliance violations committed by an acquired company could significantly impair the ultimate value of the transaction and the reputation of the acquirer. The pace of deal making between pharma and biotech companies continued to accelerate in 2006, increasing 17% to about $ 18 billion. Pharma companies were typically the buyers, and the Saecediums they paid increased substantially as competition intensified, to secure access to novel drugs and biologies. The stakes increase everyday as competition pushes up prices and drives deal-making to earlier development stages with greater uncertainty and less time to complete thorough due diligence.

1. Acquisitions of biotech companies was preferred among pharmaceutical companies in the recent past.
2. Biotech companies are not capable to acquire pharmaceutical companies.
3. Pharmaceutical companies at times may incur loss after acquisition of biotech companies.
4. Safety related issues are prime concerns for the pharmaceutical companies while negotiating acquisitions of biotech companies.
5. Stiff competitions among the prospective buyers have resulted into erosion of value of the biotech companies.

Directions (Q. 6-10): Below is given a passage followed by several possible inferences which can be drawn from the facts stated in the passage. You have to examine each inference separately in the context of the passage and decide upon its degree of truth or falsity.

Mark Answer:

(a) If the inference is 'definitely true', *i.e.*, it properly follows from the statement of facts given.

(b) If the inference is 'probably true' though not 'definitely true' in the light of the facts given.

(c) If the 'data are inadequate', *i.e.*, from the facts given you cannot say whether the inference is likely to be true or false.

(d) If the inference is 'probably false', though not 'definitely false' in the light of the facts given.

(e) If the inference is 'definitely false' *i.e.*, it cannot possibly be drawn from the facts given or it contradicts the given facts.

The latest data to show that the overall power situation has gotten worse, with the ratio for peak load shortages now the highest in a decade. In absolute terms, the power deficit has hit record levels and seems almost certain to further deteriorate without real reforms on the ground. Even as aggregate technical and commercial losses in the power system remain much high at over a third of total generation, pan-India capacity addition is now well below target. A shortage of equipment and skills is blamed for the marked; slow down in augmenting power capacity. But the dearth of resources can only be relative. In fact, the real bane of the sector is continuing revenue leakage in the state power utilities and unacceptably high aggregate technical and commercial losses, much of it plain theft of electricity. Given the preponderance of state utilities in power supply, the fact that they remain very much in red does affect investor comfort and return funds flow.

6. Pakistani power generation is largely controlled by private sector.
7. Reforms in power sector in India has not yet attained its desired level.
8. Pakistani power sector is yet to attain status comparable to developed countries.
9. Power theft is one of the major components of revenue losses in power sector.
10. Aggregate technical and commercial loss is much less than thirty per cent of the total power generation.

Directions (Q. 11-15): Below is given a passage followed by several possible inferences which can be drawn from the facts stated in the passage? You have to examine each inference separately in the context of the passage and decide upon its degree of truth of falsity.

Now, mark your answer as:

(a) If the inference is **'definitely true'** *i.e.*, it properly follows from the statement of facts given.

(b) If the inference is **'probably true'** though not 'definitely true' in the light of the facts given.

(c) If the **'data are inadequate'**, i.e., from the facts given you cannot say whether the inference is likely to be true or false.

(d) If the inference is **'probably false'**, though not 'definitely false' in the light of the facts given.

(e) If the inference is **'definitely false'**, i.e., it cannot possibly be drawn from the facts given or it contradicts the given facts.

The main benefit to the economy from an active stock market is the ready availability of risk capital for investment in equities through the primary market. For that risk capital be readily available. Investors need to have an easy exit route. A liquid secondary market provides an easy exit route through the active involvement of buyers and sellers. It does not matter whether these buyers and sellers have short or long term investment horizons. Liquidity in the market is enhanced by leveraged players who either borrow to play the market or achieve a similar result through futures contracts whose economic value includes financing costs. Short sellers confer a similar benefit by borrowing stock or achieving the same result through futures contracts.

11. Nature of activity of the long-term players in the secondary market has significant effect on the health of stock market.
12. Players in the primary market generally borrow funds and earn money by quick disposal in the secondary market.
13. Active secondary market provides liquidity to the transactions in primary market.
14. Passive stock market enhances availability of capital.
15. Only short term buyers or sellers provide effective exit route to the primary market.

ANSWERS WITH EXPLANATION

1. (a) The inference is definitely true because according to the given passage "The pace of deal making between pharma and biotech in 2006 is increasing accelerately".
2. (c) According to the passage Pharma companies were typically the buyers out it is not necessary that Biotech companies are not capable to acquire pharmaceutical companies. Hence, data is inadequate.
3. (a) The inference is definitely true as it is clearly mentioned in the passage. However, companies and their investor may risk value destruction if they acquire rights to a drug that suddenly poses unanticipated safety risks for patients.
4. (b)
5. (e) The inference is definitely false as it is given in the passage that competition pushes up prices.
6. (c) In this passage, nothing is mentioned regarding Pakistani power generation. Hence, data are inadequate.
7. (b) As the whole passage narrates for the power situation, it can be inferred that reforms in power sector in Pakistan has not yet attained its desired level Hence, the inference is probably true.
8. (c)
9. (a) Given in the passage much of it plain theft of electricity. Hence, 'definitely true.'

10. (e) Given in the passage aggregate technical and commercial losses in the power system remain much high at over a third of total generation and the inference contradicts the given facts. Hence, definitely false.

11. (b) Because the role of long term players has significant effect on the health of stock market and this inference can be probably true. We can only infer in the light of the facts given.

12. (c) No data are given in the passage.

13. (d)

14. (a)

15. (e) It contradicts the statement in the passage. The statement says that a liquid secondary market provides an easy exit route through the active involvement of buyers and sellers.

(4)

STATEMENT AND COURSE OF ACTION

In many of the competitive examinations this type of questions has become a regular feature. In such type of questions, a situation is presented and some courses of action are suggested in the context of the situation.

To solve this type of questions, students are advised to keep in mind various points.

(a) Correct course of action should either lessen the problem or improve the situation created by the problem.

(b) Course of action should be feasible and should relate with the practical aspect of life.

(c) Decide quickly whether the problem involves a problem solution relationship or a fact improvement relationship.

(d) Simple problem must have simple course of action and not a complex one which may create more problem than to solve or reduce it.

Direction: In each question below is given a statement followed by two courses of action numbered I and II. The candidates are required to grasp the statement analyse the problem and then decide which of courses of action logically follow.

Give Answer:

(a) If only I follows.
(b) If only II follows.
(c) If either I or II follows.
(d) If neither I nor II follows.
(e) If both I and II follow.

Example 1.

Statement: An increased number of credit/debit card forgery cases have been recorded recently.

Courses of Action:

(a) The banks should make stricter verification to ensure the access to credit/debit card by the authorized person.

(b) The banks should advise their customers to be more careful in dealing with the plastic money.

Solution: The course of action (a) follows because according to the statement, an increased number of credit/debit and forgery have been recorded recently. Hence, the banks should make stricter verification to ensure the access to credit/debit by the authorised person. Simultaneously the banks should advise their customers to be more careful in dealing with the plastic money. Hence, both (a) and (b) courses of action follow. Therefore, our answer is (e).

Example 2.

Statement: Drinking and rave parties have become fashion among the present college youth which divert from their studies.

Courses of Action:

(a) The State Government should make it a rule to disallow the students from entering Pubs and Bars.

(b) The parents as well as the colleges should impose strict discipline among the college going youth.

Solution: In order to stop the present college youth from drinking and attending the rave parties the State Government, the parents as well as the college should impose strict discipline among them. Hence, (a) and (b) both follow. Therefore, our answer is (e).

Examples 3.

Statement: Increasing competition on various fronts is putting children and youth under tremendous pressure leading them to take extremely drastic steps.

Courses of Action

(a) Children and youth alongwith their parents should be counselled for facing the competition in right spirit.

(b) Parents and teachers should be advised not to bring pressure on children.

Solution: Increasing competition on various fronts is putting children and youth under tremendous pressure leading them to take extremely drastic steps. In order to avoid, children alongwith their parents should be counselled for facing the competition in right spirit. Hence. (a) action follows (b) is not proper. Therefore, our answer is (a).

EXERCISE

Directions (Q. 1-5): In each question below is given a statement followed by two courses of action numbered (a) and (b). A course of action is a step or administrative decision to be taken for improvement, follow-up or further action in regard to the problem, policy, etc. On the basis of the information given in the statement, you have to assume everything in the statement to be true, then decide which of the suggested courses of action logically follow(s) for pursuing.

Give Answer:

(a) If only I follows.
(b) If only II follows.
(c) If either I for II follows.
(d) If neither I nor II follows.
(e) If both I and II follow.

1. **Statement:** Misuse of subsidies offered to the farmers was observed and brought to the notice of the concerned authorities.

Courses of Action:

(a) Government should issue orders to the concerned officials to be stricter and if more careful while verifying the required; documents while granting subsidy.

(b) Government should take stringent action against those making false claim of subsidy.

2. **Statement:** Expensive clothes and accessories are becoming a growing need among college going teenage children of middle-income group.

Courses of Action:

(a) Colleges should introduce a dress code.

(b) Children should be counseled emphasizing the importance of many other things.

3. **Statement:** People in the locality were agitated as more than thirty people died in a building collapse.

Courses of Action:

(a) Government should immediately announce compensations for the affected families.

(b) Authorities should take a stringent action against builders tending to compromise over quality of material used.

4. **Statement:** With the onset of monsoon all the hospitals are getting increased number of patients due to various epidemics.

Courses of Action:

(a) Civic authorities should educate the public the need for observing minimum required hygiene.

II. Civic authorities should make arrangements to equip the hospitals with required medicines and other facilities.

5. **Statement:** More number of students passing SSC examination has resulted into frustration among children for not getting admissions into colleges of their choice.

Courses of Action:

(a) Government should permit the colleges to increase the number of seats.

(b) Children and their parents should be counselled for being flexible on the choice of college.

Directions (Q. 6-10): In each question below is given a statement followed by two courses of action numbered (a) and (b). A course of action is a step or administrative decision to be taken for improvement, follow-up or further action in regard to the problem, policy, etc. On the basis of the information given in the statement, you have to assume everything in the statement to be true, then decide which of the suggested courses of action logically follow(s) for pursuing.

Give Answer:

(a) If only I follows.
(b) If only II follows. .
(c) If either I or II follows.
(d) If neither I nor II follows
(e) If both I and II follow.

6. **Statement:** The local college principal has ordered that all the students must strictly adhere to the dress code stipulated by the college authority in the admission brochure.

Courses of Action:

(a) Those students who are found to violate the dress code should be terminated from the college.

(b) Those students who are found to violate the dress code for the first time should be reprimanded and be warned against further violation.

7. **Statement:** The railways have decided to repair the main tracks within the city on the following Sunday and has decided to suspend operations for the whole day.

Courses of Action:

(a) The railway authority should issue public notification well in advance to ease inconvenience to the passengers.

(b) All the long distance trains at the time of repair hours should be terminated outside the city limit.

8. **Statement:** Many motorists driving on the highway within the city are found to be driving much beyond the permissible speed limit.

Courses of Action:

(a) The traffic police officials should personally monitor the movement of vehicles on the highway within the city.

(b) The Govt. should immediately put in place a mechanism to identify and punish erring drivers.

9. **Statement:** Majority of the city employees in the renowned BPO Company has left their jobs to protest against inhuman treatment meted out to them by the company.

Courses of Action:

(a) The Govt. should immediately order the BPO Company to close down its operation.

(b) The BPO Company should shift its operations to some other place to continue its operations.

10. **Statement:** The management of the organization has issued a circular to all its employees stating that each employee must report for duty at 10.00 a.m. sharp and should remain in his/her work place till 5.30 p.m. everyday.

Courses of Action:

(a) The management should evolve a mechanism to identify such employees who may not adhere to the time schedule.

(b) All such employees who are found to be failing to maintain time schedule should be summarily suspended.

Directions (Q. 11-15): In each question below is given a statement followed by two courses of action numbered (a) and (b). A course of action is a step or administrative decision to be taken for improvement, follow-up or further action in regard to the problem, policy, etc. On the basis of the information given in the statement, you have to assume everything in the statement to be true, then decide which of the suggested courses of action logically follow(s) for pursuing.

Give Answer:

(a) If only I follows.
(b) If only II follows.
(c) If either I or II follows.
(d) If neither I nor II follows.

(e) If both I and II follow

11. **Statement:** A speeding truck has seriously injured many persons sleeping on the roadside early in the morning.

Courses of Action:

(a) The local administration should immediately put a complete ban on people sleeping on the roadsides.

(b) The driver of the speeding truck should be nabbed and tried for the crime he committed.

12. **Statement:** There has been an unprecedented increase in the number of students applying for admission to first Std. in a local school making it difficult for the school authority to convince the parents of rejected applicants.

Courses of Action:

(a) There has been an unprecedented increase in the number of students applying for admission to first Std. in a local school making it difficult for the school authority to convince the parents of rejected applicants.

(b) The school authority should open another school in the area to accommodate the remaining students.

13. **Statement:** The apex court has directed that there is a need to bring in mechanism in the Govt. functions to make it transparent.

Courses of Action:

(a) The Govt. should immediately appoint a task force to work out the modalities.

(b) The Government should appeal to the apex court to reconsider its directive.

14. **Statement:** Many people in the coastal town are suffering from respiratory diseases during past few months.

Courses of Action:

(a) The Government should immediately send a team of health professional to provide medical care to the affected people.

(b) The people suffering from such diseases should be kept in a special ward and put through proper medication.

15. **Statement:** There has been a substantial drop in number of people opting for new telephone connection from the public sector telephone company in the recent months.

Courses of Action:

(a) The public sector telephone company should immediately set up a committee to identify the reasons for the drop.

(b) The public sector telephone company should offer new schemes with value added services to woo the new clients.

Directions (Q. 16-20): In each question below is given a statement followed by two courses of action numbered (a) and (b). A course of action is a step or administrative decision to be taken for improvement, follow-up or further action in regard to the problem, policy, etc. On the basis of the information given in the statement, you have to assume everything in the statement to be true, then decide which of the suggested courses of action logically follow(s) for pursuing.

Give Answer:

(a) If only I follows (b) If only II follows.

(c) If either I or II follows; (d) If neither I nor II follows.

(e) If both I and II follow.

16. **Statement:** The parents of majority of the students of the local public school have decided to withdraw their wards from the schools to protest against the sharp fee hike.

Courses of Action:

(a) The school authority should start a dialogue with the parents and explain to them the circumstances under which the fees had to be hiked.

(b) The school authority should immediately scout for new students to fill the vacancy if large number of students are withdrawn from the school.

17. **Statement:** The prices of mangoes in the local market have dropped substantially due to supply-demand mismatch.

Courses of Action:

(a) The Govt. should encourage the wholesale fruit suppliers to sell the mangoes to the markets of other states.

(b) The Govt. should encourage the fanners to extract pulp and sell the pulp to the wholesalers.

18. **Statement:** A large mob gathered outside the local police station to protest the recent harassment of local people by some police personnel.

Courses of Action:

(a) The officer in charge of the police station should be instructed to persuade the mob to disburse immediately.

(b) The police authority should immediately initiate an enquiry into the allegations and inform the public accordingly.

19. **Statement:** The prices of crude oil in the international market have risen by about 40 per cent in a month's time and show no downward trend.

Courses of Action:

(a) The petrol prices in the domestic retail market should immediately be increased by about 30 per cent to absorb the cost escalation.

(b) The Govt. should provide subsidy to the oil marketing companies to absorb the cost escalation.

20. **Statement:** Many students were caught red handed while using unfair means during the recent university examinations.

Courses of Action:

(a) All these students should be debarred from taking university examination in future.

(b) The students apprehended while using unfair means should be handed over to the police.

Directions (Q. 21-25): In each question below is given a statement followed by two courses of action numbered (a) and (b). A course of action is a step or administrative decision to be taken for improvement, follow-up or further action in regard to the problem, policy, etc.

On the basis of the information given in the statement to be true, and then decide which of the suggested courses of action logically follow(s) for pursuing.

Give Answer:

(a) If only I follows.
(c) If either I or II follows.
(e) If both I and II follow.
(b) If only II follows.
(d) If neither I nor II follows.

21. **Statement:** With the arrival of monsoon, the condition of roads in the city has begun to deteriorate.

Courses of Action:

(a) The Road-Development Authorities should be directed by the State Govt. to take up regular up-keeping of the roads.

(b) People should be encouraged to use the pooled/public transport by improving the system to take care of their needs and expectations.

22. **Statement:** Despite consistent economic growth, our country has not been able to eradicate poverty.

Courses of Action:

(a) The Government should focus their attention towards the below poverty line strata of society.

(b) People in the high income group should volunteer and contribute to the Government's plan of poverty eradication.

23. **Statement:** Incidences of terror attacks are on a constant rise since last few years.

Courses of Action:

(a) Strict control should be imposed on immigrants across the states,

(b) Commuters should not be allowed to carry baggage in shared public transport.

24. **Statement:** Every year "there is an increasing number of students committing suicide due to fear of failure.

Courses of Action:

(a) Parents and teachers should not put pressure on children for high achievement, rather they should help children face the situation as it comes.

(b) School/college authorities should appoint counsellors for regular conselling of students.

25. **Statement:** Quite a few cases of post-calamity false claims have been noticed by the concerned Govt. authorities.

Courses of Action:

(a) Government should ensure stricter verification of identity by the concerned officials.

(b) Government should deploy more number of officials to handle the situation.

ANSWERS WITH EXPLANATION

1. (e)	2. (b)	3. (a)	4. (b)	5. (e)	6. (a)	7. (c)
8. (d)	9. (b)	10. (b)				

11. (e) Both action I and II follows.

12. (d) Neither (a) nor (b) action follows, because after rejecting the application, there is no importance of objective criteria. And it is not possible to open another school recently.

13. (a) Only action I follows.

14. (b) Only action II follows because it contains cause to check the diseases with medical care.

15. (e) To put both the actions successively is necessary.

16. (a) Only the course of action I follows because parents can change their decisions just knowing the circumstances. But the course of action II cannot be done quickly. By the way, if the course of action II is imposed quickly the mentality of forthcoming parents will be same also.

17. (e) Both the actions follow, because Government has rights to take the decision of proper consumption of mangoes, which can check the destruction of natural material. Being the higher supply it is possible that the excess mangoes out of consumption may be rotten. Therefore, both the courses of actions are legal.

18. (b) The course of action II follows, because giving faith of immediately initiate an enquiry, it is possible to give the peace to the mob. If the police-force is used to disturb the mob, in such a position the mob may be more infuriated of which result will not be good.

19. (c) Either course of action I or II follows. If the costs are to be increased in the domestic retail market, then it is not good to provide subsidy to the oil marketing companies and if the subsidy is to be provided to the marketing companies then the price should be remain constant in the retail market.

20. (a) The course of action I follows, because when the students were caught red handed while using unfair means in the examinations the students are in blame. Keeping the education level in view they should be punished by an education means, so that all other students will change their mind not to do so. The second course of action is not so proper.

21. (a) Only (I) follows because Road Development Authorities are made by the State Government to take care regular up-keeping of the roads. But II does not follow because it is not possible to use public transport to go everywhere.

22. (e) Both I and II follow. If the Government make some employment plans for the people below the poverty line then their poverty can be removed. If the people in the high income group, help with money voluntarily to plans made by Government, it be helpful in the development of the poor.

23. (e) Both the actions follow. By strict control on immigrants, we should focus and observe each and every immigrant across the State. Commuters should not be allowed to carry baggage in shared public transport, because it is be possible that they carry some bombastic things.

24. (e) Both I and II follow. The I.Q. of all students are different. Hence, parents and teachers should not pressure on children for high achievement otherwise the students commit suicide due to fear of failure. Besides school authorities should appoint counsellers; for regular counselling of students.

[redacted]

25. (a) Only I follows. If the verification of identity of the concerning man is done correctly men false claims can be ruled out. II does not follow because there is no use to deploy more number of officials to handle the situation.

ANALYTICAL REASONING OR PROBLEM SOLVING

Questions based upon analytical reasoning are undoubtedly the longest and most time consuming of all types of question that can be asked in various examinations. However, their importance in exams cannot be underestimated as these questions decide merit of a Test.

Example: Read the following information carefully and answer the questions that follow. There are six cities (a), (b), (c), (d), (e) and (f). A is not a hill station. (b) and (e) are not historical places. D is not an industrial city. A and D are not historical places. A and B are not alike.

1. Which two cities are industrial centres?
   (a) A and B (b) E and F (c) C and D (d) B and F
   (e) A and D
2. Which two cities are historical places?
   (a) A and C (b) B and F (c) C and F (d) B and E.
   (e) A and D
3. Which two cities are hill stations?
   (a) A and B (b) C and A (c) B and D (d) A and F
   (e) None of these
4. Which city is a hill station and an industrial centre but not a historical place?
   (a) E (b) F (c) A (d) B
   (e) C
5. Which two cities are neither historical places nor industrial centres?
   (a) A and B (b) D and E (c) F and C (e) None of these
   (d) B and D

Some important steps to solve such type of questions.

Read the question carefully by keeping in mind every point or detail. It will take a few seconds. After reading the question, you will get the general idea as to what the general theme of the problem is. Determine the usefulness of each of the information and classify all the information into (a) Actual information (b) Useful secondary information and finally (c) Negative information. Refer to example given below:

Detailed Explanation

Step I: The informations can be analysed in the following manner.

	A	B	C	D	E	F	G
Historical							
Industrial							
Hill Station							

Step II—In above-mentioned example, we see that the first and last sentences have useful secondary information whereas all the remaining have negative information. By studying the second, third, fourth and fifth sentences we put x mark.

	A	B	C	D	E	F
Historical	×	×		×	×	
Industrial	✓			×		
Hill Station	×			✓		

We can observe that above table gives some definite information about A and D. When A is neither a historical city nor a hill station. It is, therefore, an industrial city. In the same way D is neither historical nor industrial so it must be a hill station. We can ✓ mark at the appropriate places.

Step III: Finally we come to useful secondary information and negative information. For instance, A and B are not alike. This means that B is not an industrial city. As B is not a historical place. So, it must be hill station. Now, all the remaining informations are negative. A lack of negative information about a city would mean that the city does have the quality whose absence is not mentioned.

Here in the example, there are no negative information about C and F and partly about E. We can assure that C and F are hill station, industrial and historical cities and E is industrial as well as hill station.

Now, our final Table is as below:

	A	B	C	D	E	F
Historical	×	×	✓	×	×	✓
Industrial	✓	×	✓	×	✓	✓
Hill Station	×	✓	✓	✓	✓	✓

On the basis of above table, the answers can be drawn.

1. (b) 2. (c) 3. (c) 4. (a) 5. (d)

The problems can be classified into the following (1) Classification or categorization (2) Question based on blood relation (3) Seating and placing arrangements (4) Comparison type test (5) Sequential order of things (6) Selection based on certain given pre-conditions.

1. CLASSIFICATION OR CATEGORIZATION

In this type of test, the questions are asked based upon the given data belonging to different groups or possessing different qualities. You would be supposed to analyse these data by placing the different items or concepts in different categories with the help of given information. These problems can be easily solved by constructing a proper table or chart.

Example 1. Six friends P, Q, R, S, T and U are the members of a club. They play Football, Cricket, Tennis, Basketball, Badminton and Volleyball.

1. T, who is taller than P and S, plays football.
2. The tallest member plays basketball.
3. The shortest member plays volleyball.
4. Q and S neither play volleyball nor play basketball.
5. R plays volleyball.

6. According to height T is in between Q, who plays football, and P is shorter than T. Who plays Basketball?

(a) Q (b) R (c) S (d) U

(e) None of these

Answer with Explanation: Writing the information on a chart.

Member	Name of the game	Height
P		Shorter than T
Q	Football	Taller than T
R	Volleyball	Shortest
S		Shorter than T
T	Tennis	Shorter than U
U	Basketball	Tallest .

Example 2. Six students P, Q, R, S, T and U are studying different subjects for their Master Degree. The subjects are English, History, Philosophy, Physics, Statistics and Mathematics.

1. In these students, two live in hostel, two are paying guests and remaining two are living in their homes.
2. R is not a paying guest and study Philosophy.
3. The students who are studying History and Statistics are not paying guests.
4. T and S study Mathematics and Statistics respectively.
5. U and S live in the hostel.
6. T is a paying guest and Q lives in his home. Find out who is in study of English?

(a) S (b) T (c) U (d) R

(e) None of these

Name of the students	Subjects	Residence
P	English	Paying guest
Q	History or Statistics	Home
R	Philosophy	Home
S	Physics	Hostel
T	Mathematics	Paying guest
U	Statistics or History	Hostel

From the above chart it is clear that P studies English which is not given in options.

EXERCISE

Directions (Q. 1-5): Study the following information carefully and answer the questions that follow:

(i) Mazhar and Shabnam are good in Dramatics and Computer Science.

(ii) Anam and Mazhar are good in Computer Science and Physics.

(iii) Anam, Azra and Nishat are good in Physics and History.

(iv) Nishat and Anam are good in Physics and Mathematics.

(v) Azra and Shabnam are good in History and Dramatics.

1. Who is good in Computer Science, History and Dramatics?
(a) Anam (b) Mazhar (c) Shabnam (d) Nishat

2. Who is good in Physics, Dramatics and Computer Science?
(a) Shabnam (b) Azra (c) Mazhar (d) Anam

3. Who is good in Physics, History and Dramatics?
(a) Azra (b) Shabnam (c) Mazhar (d) Anam

4. Who is good in History, Physics, Computer Science and Mathematics?
(a) Azra (b) Nishat (c) Mazhar (d) Anam

5. Who is good in Physics, History and Mathematics but not in Computer Science?
(a) Mazhar (b) Azra (c) Nishat (d) Anam

Directions (Q. 6-9): Read the following information carefully and answer the question that follow:

Four young men Raja, Saeed, Waheed and Meraj are friendly with four girls Shazia, Kalsum, Aasia and Azra. Shazia and Aasia are friends. Waheed's girl friend does not like Shazia and Aasia. Kalsum does not care for Waheed. Saeed's girls friend is friendly with Shazia. Shazia does not like Raja.

6. Who is Raja's girl friend?
(a) Shazia (b) Kalsum (c) Aasia (d) Azra

7. With whom Shazia is friendly?
(a) Raja (b) Saeed (c) Waheed (d) Meraj

8. Who is Azra's boy friend?
(a) Meraj (b) Waheed (c) Saeed (d) Raja

9. Who does not like Shazia and Aasia?
(a) Azra (b) Raja (c) Meraj (d) Waheed

Directions (Q. 10-14): Read the following information carefully and answer the questions that follow:

(i) P.Q.R.S.T and U are six students procuring their Master's Degree in six different subjects—English History, Philosophy, Physics, Statistics and Mathematics.

(ii) Two of them stay in hostel, two stay as paying guest (PG) and the remaining two stay at their homes.

(iii) R does not stay as PG and studies Philosophy,

(iv) The students studying Statistics and History do not stay as PG.

(v) T studies Mathematics and S studies Physics. U and S stay in Hostel. T stays as PG and Q stays at home.

10. Who studies English?
(a) R (b) S (c) T (d) U
(e) None of these

11. Which of the following combination of subjects and place of stay is not correct?
(a) English-Hostel
(b) Mathematics-PG
(c) Philosophy-Home
(d) Physics-Hostel
(e) None of these

12. Which of the following pairs of students stay one each at hostel and at home?
(a) QR
(b) SR
(c) US
(d) Data inadequate
(e) None of these

13. Which subject does Q study?
(a) History
(b) Statistics
(c) History or Statistics
(d) Date inadequate
(e) None of these

14. Which of the following pairs of students stay at home?
(a) PQ
(b) QR
(c) RS
(d) ST
(e) None of these

ANSWERS WITH EXPLANATION

For Question No. 1 to 5.

From the given information we can make a chart as follows:

	Dramatics	Compt. Sci.	Physics	History	Mathematics
Mazhar	✓	✓	✓	×	×
Shabnam	✓	✓	×	✓	×
Anam	×	✓	✓	✓	✓
Azra	✓	×	✓	✓	×
Nishat	×	×	✓	✓	✓

1. (c) 2. (c) 3. (a) 4. (d) 5. (c)

For Question No. 6 to 9.

As per information Shazia and Aasia are friends and Saeed's girl friend is friendly with Shushama. It is clear that Saeed's girl friend is Aasia. Waheed's girl friend does not like Shazia and Aasia. Hence, she may be Kalsum or Azra. But Kalsum dislikes Waheed. Therefore, Waheed's girl friend is Azra. Sushama does not like Raja. So, Raja's girl friend is Kalsum. Clearly, Shazia is Meraj's girl friend.

6. (b) 7. (d) 8. (b) 9. (a)

For Question No. 10 to 14.

	P	Q	R	S	T	U
Subject	English	Statistics History	Philosophy	Physics	Mathematics	Statistics History
Accommodation	Paying guest	Home	Home	Hostel	Paying Guest	Hostel

10. (e) P studies English.
11. (a)
12. (b) S stays at hostel and R stays at home.
13. (c) History or Statistics.
14. (b)

2. BLOOD RELATIONS WITH THEIR RELATIONSHIP AND PROFESSIONS

For solving this type of questions where persons engaged in different professions and they are also relatives to one another in which some clues are also given regarding relationship among different members of a family and their professions, qualities, dresses, preferences etc. On the basis of given informations, students are advised to draw a family tree of the generations and analyse the whole information and then answer the given questions accordingly.

Example 1. Read the following information carefully and answer the questions that are given below:

(i) P, Q, R, S, T and U are travelling in a bus.

(ii) There are two reporters, two technicians, one photographer and one writer in the group.

(iii) The photographer P is married to S who is a reporter.

(iv) The writer is married to Q who is in the same profession as that 'U'.

(v) P, R, Q, S are two married couples and nobody in the group has same profession.

(vi) U is brother of R.

1. Which of the following is a pair of technicians?
(a) RS (b) SU (c) PT (d) QU

2. Which of the following is a pair of reporters?
(a) PQ (b) RT (c) ST (d) SU

3. How is R related to U?
(a) Brother (b) Sister (c) Uncle (d) Cannot be determined

4. Which of the following is a couple?
(a) PQ (b) QR (c) QS (d) PT

5. Which of the following is a pair of husbands?
(a) PQ (b) PR (c) QS (d) Cannot be determined

ANSWERS WITH EXPLANATION

From the statement (iii), the Photographer is married to S who is reporter. It means one couple is PS and another is (RQ). From statement (V) in six persons P's profession is photographer and S's profession is reporter, it means that in remaining four members, there are two technicians one writer and one reporter. The writer is married to B who is in same profession as that of U. Another couple is RQ is which R is writer and Q and U have same profession because there are two technicians. Now, only T is there and his profession is reporter because there are two reporters and we have known one reporter which has been given in the statement (iii). It is clear that T must be the second reporter.

P	Q	R	S	T	U
↓	↓	↓	↓	↓	↓
Photographer	Technician	Writer	Reporter	Reporter	Technician

P + S — First couple.

R + Q — Second couple.

1. (d) 2. (c) 3. (d) 4. (b) 5. (d)

Example 2. Study the following information carefully and answer the questions given below it.

(1) P,Q,R,S,T and U are six members in a family in which there are two married couples.

(2) T, a teacher, is married to the doctor who is mother of R and U.

(3) Q, the lawyer, is married to P

(4) P has one son and one grandson.

(5) Of the two married ladies one is housewife.

(6) There is one student and one male engineer in the fam

1. How is P related to R?
(a) Grandfather (b) Mother (c) Sister (d) Grandmother
(e) None of these

2. Who among the following is housewife?
(a) P (b) Q (c) S (d) T
(e) None of these

3. How R related to U?
(a) Brother (b) Sister: (c) Brother or Sister
(d) Data inadequate (e) None of these

4. Which of the following represents the group of females in the family?
(a) PSR (b) PSU (c) QTR
(d) Data inadequate (e) None of these

5. Which of the following is true about the grand daughter in the family?
(a) She is a lawyer (b) She is a student
(c) She is an engineer (d) Data inadequate
(e) None of these

ANSWERS WITH EXPLANATION

There are two couples in six members as mentioned in statement 3. One couple is PQ and another couple is T and S and their two children in which one is student or another is male engineer. They are R and U. When T teacher married to S doctor and Q lawyer is married to P who is housewife because one married lady S is house wife. P the housewife has one son who is married to T teacher and a grandson who is a male engineer from R and U. B between R and U sex cannot be determined.

The following chart can well elaborate the professions and their relations.

P	Q	R	S	T	U
↓	↓	↓	↓	↓	↓
Housewife	Lawyer	Student/Engineer	Doctor	Tech	Student/ Engineer

(1) Couple P + Q (2) Couple S + T

ANSWERS

1. (d) P is the grandmother of R.

2. (e) P is the housewife
3. (c) R may be brother or Sister of U
4. (d) Since, the sex of R and U is not given so the set of three females cannot be determined.
5. (b) The granddaughter is a student.

EXERCISE

Directions (Q. 1-5): Read carefully the following information for answering the given questions.

(i) A, B, C, D, E and F are the six members of a group. In this group, there are two married couples.

(ii) There are two teachers, one doctor, one lawyer and two engineers. Both the teachers are of same sex.

(iii) A and C are in the same profession.

(iv) Doctor is married to teacher. One: engineer is married to female lawyer.

(v) A is an engineer. E is a male teacher. Both are unmarried.

(vi) F is the husband of 'B'.

1. Which of the following is a pair of two married couples?

(a) CD, FB (b) CB, DF (c) ED,CB

(d) Cannot be determined (e) None of these

2. What is the profession of B?

(a) Lawyer (b) Doctor (c) Teacher

(d) Cannot be determined (e) None of these

3. How many male members are in the group?

(a) More than three (b) Two (c) Three

(d) Cannot be determined (e) None of these

4. Who is the lawyer in the group?

(a) C (b) F (c) B

(d) Cannot be determined (e) None of these

5. Who is married to Doctor?

(a) B (b) D (c) F

(d) Cannot be determined (e) None of these

Directions (Q. 6-10): P, Q, R, S, T, V and W are the members of a family. In this family there are three ladies and four gents. In this group two members are managers, two lawyers one teacher, one engineer and one doctor. Neither of the ladies is a teacher or an engineer. R is a lawyer who is married with P, the teacher. Engineer V is married to S who is neither lawyer nor doctor. Now, two ladies have same profession. W, who is a manager and his sister is Q.

6. What is the profession of T?

(a) Manager (b) Lawyer (c) Manager or Lawyer

(d) Data inadequate (e) None of these

7. What is the profession of Q?

(a) Doctor (b) Manager (c) Lawyer
(d) Data inadequate (e) None of these

8. **Which of the following is a group of males?**
(a) PQVW (b) TVSW (c) PRTV (d) PTVW
(e) None of these

9. **Which of the following pairs have same profession?**
(a) PS (b) RS (c) TP (d) WT
(e) None of these

10. **Which of the following has the same profession which D belongs?**
(a) R (b) T (c) S
(d) Data inadequate (e) None of these

Directions (Q. 11-15): All the questions are based on the following information. Five men A, B, C, D and E and their wives P, Q, R, S and T join a dance party, but it is not necessary that the order of husbands and wives are the same. This is the information that:

(i) Husbands dance only with their wives.
(ii) C has a sister T and has only a brother A.
(iii) If D has danced with T, it means that he danced with another's wife.
(iv) B does not dance with Q or T or S.
(v) P is wife of A's brother.
(vi) Q did not dance with D.

11. **With whom R danced?**
(a) B (b) C (c) D (d) E

12. **If 'B' and 'D' interchange their partners who will dance with 'B'?**
(a) P (b) Q (c) R (d) S

13. **If E is the D's son, how is B related to Q?**
(a) Brother-in-law (b) Son
(c) Son-in-law (d) Cannot be determined

14. **How many members are from the same family since birth?**
(a) 2 (b) 7 (c) 4 (d) Minimum 3

15. **If such type of dance is organized, how many dances are possible that each man dance with opposite sex?**
(a) 8 (b) 16 (c) 25 (d) 20

ANSWERS WITH EXPLANATION

For Question No. 1 to 5.

Member	Profession	Sex and Relation
A	Engineer	Unmarried, Male/Female
B	Doctor	Female, Teacher's wife
C	Engineer	Male, Lawyer's husband
D	Lawyer	Female, Engineer's wife
E	Teacher	Male, Unmarried.
F	Teacher	Male, Doctor's husband

1. (a) 2. (b) 3. (d) 4. (e) 5. (c)

For Question No. 6 to 10.

Members of the family	Sex	Profession
P	Gent	Teacher
Q	Lady	Doctor
R	Lady	Lawyer
S	Lady	Manager
T	Gent	Lawyer
V	Gent	Engineer
W	Gent	Manager

6. (b) T is a lawyer. 7. (a) Q is a doctor.
8. (d) The group of gents is PTVW.
9. (e) From the given pairs, no one has the same profession.
10. (c) W is a manager as well as S is the manager.

For Question No. 11 to 15.

The pair of Husband and Wife.

Husband	Wife
A	Q
B	R
C	P
D	S
E	T

11. (a) 12. (d) 13. (d) 14. (d) 15. (c)

3. SEATING AND PLACING ARRANGEMENTS

In this type of questions, some information or facts are given regarding seating or placing arrangements, whether the sequence may be linear or circular in which either the persons or objects are given. The candidate is required to solve these questions in proper sequence and he/she can use various clues and information given in the question.

There are few examples which describe the seating or placing arrangement.

Example: Study the following (for question 1-5) information carefully and answer the given question below it. Five friends A, B, C, D and E are sitting on a bench.

(i) A is sitting next to B. (ii) C is sitting next to D.
(iii) D is not sitting with E. (iv) E is on the left end of the bench.
(v) C is on the second position from the right.
(vi) A is on the right of B and E. (vii) A and C sitting together.

1. Where is A sitting?

(a) Between B and D (b) Between D and C
(c) Between E and D (d) Between C and E
(e) Between B and C

2. **Who is sitting in the centre?**

(a) A (b) B (c) C (d) D (e) E

3. ***C* is sitting between:**

(a) B and D
(b) A and E
(c) D and E
(d) A and D
(e) A and B

4. **What is the position of D?**

(a) Extreme left
(b) Extreme right
(c) Third from left
(d) Second from left
(e) None of these

5. **What is the position of B?**

(a) Second from right
(b) Centre
(c) Extreme left
(d) Second from left
(e) None of these

ANSWERS WITH EXPLANATION

From the given information first of all, we see which one is positive information and we find that 4th and 5th sentences constitute definite and positive information. 1st, 2nd, 6th and 7th are comparative information and remaining 3rd is a negative information. We start from the definite information and draw the following diagram

E .... C ...

and now with the help of comparative information which tells about E and C from the 7th, 2nd and 6th sentences which lead to

EBAC ... and finally with the help of 2nd sentence:

E B A C D

ANSWERS

1.	(e)	2.	(a)	3.	(d)	4.	(b)	5.	(d)		

EXERCISE

1. **There are five different houses A to E in a row. A is to the right of B and E is to the left of C and right of A. B is to the right of D. Which of the houses is in the middle? (a) A (b) B (c) D (d) E**

Directions—(Q. 2-4): Read the following information carefully and answer the questions given below it.

(a) There are five friends.
(b) They are standing in a row facing south.
(c) Javed is immediate right of Akram.
(d) Parwana is between Bashir and Sabir.
(e) Sabir is between Javed and Parwana.

2. **Who is at the extreme left end?**

(a) Akram
(b) Bashir

(c) Sabir (d) Data inadequate
(e) None of these

3. **Who is in the middle?**
(a) Bashir (b) Javed
(c) Parwana Akram (d) Sabir

4. **To find answers to the above-mentioned two questions, which of the given statements can be dispensed with?**
(a) None (b) A only (c) B only (d) C only

Directions—(Q. 5-9): Read the following information carefully and answer the questions given below it.

(i) Eight persons E, F, G, H, I, J, K and L are seated around a square table—Two on each side.
(ii) There are three lady members and they are not seated next to each other.
(iii) J is between L and F.
(iv) G is between I and F.
(v) H, a lady member, is second to the left of J.
(vi) F, a male member, is seated opposite E, a lady member.
(vii) There is a lady member between F and I.

5. **Who among the following is seated between E and H?**
(a) F (b) I (c) J
(d) Cannot be determined (e) None of these

6. **How many persons are seated between K and F?**
(a) One (b) Two (c) Three
(d) Cannot be determined (e) None of these

7. **Who among the following are three lady members?**
(a) E, J and G (b) E, H and G (c) G, H and J
(d) Cannot be determined (e) None of these

8. **Who among the following is to the immediate left of F?**
(a) G (b) I (c) J
(d) Cannot be determined (e) None of these

9. **Which of the following is true about J?**
(a) J is a male member (b) J is a female member
(c) Sex of J cannot be determined
(d) Position of J cannot be determined (e) None of these

Directions—(Q. 10-12): Study the given information carefully and answer the questions that follows.

(i) There are seven books, one each of Psychology, Urdu, English, Sociology, Economics, Education and Accountancy lying on a table one above the others.
(ii) Sociology is on the top of all books.
(iii) Accountancy is immediately below Education which is immediate below Sociology.

(iv) Economics is immediately above Psychology but not in the middle.

(v) Urdu is immediately below Psychology.

10. Economics is between which of the following books?

(a) Accountancy and Education (b) Psychology and Urdu

(c) English and Psychology (d) Psychology and Sociology

(e) None of these

11. Which three books are between Accountancy and Urdu?

(a) English, Economics and Psychology

(b) Economics, Psychology and Education

(c) Economics, Psychology arid Urdu

(d) Cannot be determined (e) None of these

12. If Sociology and English, Accountancy and Urdu and Education and Psychology inter-change their position, which book will be between Psychology and Sociology?

(a) Accountancy (b) Psychology (c) Urdu (d) Economics

(e) None of these

Directions—(Q. 13-17) Read the following information carefully and answer the questions given below it.

Seven friends Kamala, Manish, Ramzan, Aamir, Ghazanfar, Fatima and Parveen are sitting in a circle. Kamal, Manish, Ramzan, Aamir, Fatima and Parveen are sitting at equal distance from each other. Ramzan is sitting two places right of Fatima, who is sitting one place right of Aamir. Kamala forms an angle of 90 degree from Ghazanfar and angle of 120 degree from Manish. Manish is just opposite Parveen and is sitting on the left of Ghazanfar.

13. Who is the only person sitting between Ramzan and Manish?

(a) Fatima (b) Aamir (c) Ghazanfar (d) Kamala

14. Ghazanfar is not sitting at equal distance from—

(a) Ramzan and Fatima (b) Aamir and Kamala

(c) Manish and Fatima (d) All of these

15. Ghazanfar is sitting ...... of Parveen.

(a) To the left (b) To the right

(c) Two places right (d) None of these

16. The angle between Ghazanfar and Manish in the clockwise direction is—

(a) 150° (b) 180° (c) 210° (d) None of these

17. Which of the following statements is not correct?

(a) Fatima is between Manish and Kamala

(b) Manish is two places away from Parveen

(c) Ghazanfar is sitting apposite Fatima

(d) All of the above

ANSWERS WITH EXPLANATION

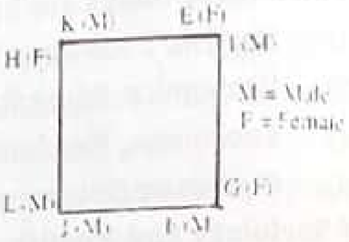
1. (a) B is the right of D. A is to the right of E is to the right of A and left of C. Therefore, the order is:

D B A E C

Clearly, A's house is in the middle position.

For Question No. 2 to 4.

On the basis of information we can draw the following diagram displaying the seating arrangement on a square table.



E is seated opposite F. Since G is between F and I. So G is a female member.

5. (e) 6. (c) 7. (b) The three lady members are E, H and G.

8. (c) 9. (a) Clearly, J is a male member.

For Question No. 10 to 12.

The book of Sociology is on the top of all books. Education is below Sociology. Accountancy is below Education. Economics is above Psychology and Psychology is above Urdu; In the statement that the Economics is not in the middle. It is clear that the remaining book English must be in middle.

Thus, the sequence of books from top to bottom is

Sociology, Education, Accountancy, English, Economics, Psychology, Urdu.

10. (c) Economics is between English and Psychology.

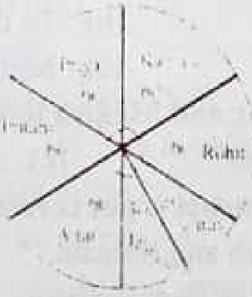
11. (a) There are three books between Accountancy and Urdu *viz.*, English, Economics and Psychology.

12. (c) The new sequence will be English, Psychology, Urdu, Sociology, Economics, Education and Accountancy.

Clearly, Urdu is between Psychology and Sociology.

For Question No. 13 to 17.

From the information the sitting arrangement in a circle is as follows:



3 (c) Ghazanfar is sitting between Ramzan and Manish.

14 (a) Ghazanfar is not at equal distance from Ramzan and Fatima or Aamir and Kamala or Manish and Fatima.

15 (d) Ghazanfar is three places left or four places right of Parveen.

16 (d) The angle between Ghazanfar and Manish in clockwise direction is 30°.

17. (d) Clearly, all the statements follow the diagram above mentioned.

(4)

COMPARISON TYPE TEST

In Such type of questions, comparison of different objects or person has to be made with respect to one or, more qualities. The candidates are required to analyse the information and form either ascending or descending sequence. There may be comparison of heights, marks and age etc.

These can be illustrated through the given example:

Example: Read the information given below and answer the questions that follow:

(i) There is a group of five girls.

(ii) Kalsum is second in height but younger than Nazia.

(iii) Saima is taller than Marina but younger in age.

(iv) Nazia and Marina are of the same age but Nazia is tallest among them.

(v) Neelam is taller than Saima and elder to Nazia.

1. If they are arranged in the ascending order of height who will be in third position?

(a) Marina
(b) Nazia
(c) Marina or Nazia
(d) Data inadequate
(e) None of these

2. If they are arranged in the descending order of their ages who will be in fourth position?

(a) Marina or Nazia
(b) Kalsum
(c) Marina
(d) Data inadequate
(e) None of these

3. To answer the question, "Who is the youngest person in the group", which of the given statements is superfluous?

(a) Only (i)
(b) Only (ii)
(c) Only (v)
(d) Either (i) or (iv)
(e) None of these

ANSWERS WITH EXPLANATION

We have to determine the sequence of height as well as sequence of age.

By (iii), we have $M < P$

By (v), we have $P < N$

It is clear that Nazia is the tallest and Kalsum is second in height.

Hence, the sequence of height is

$$M < P < N < K < R$$

For Age sequence

By (ii) we have $K < R$
(iii) we have $P < M$
(iv) we have $R = M$
(v) we have $R < N$

There are two possibilities

I is N < R = M < K < P

H is N < R = M < P < K

1. Clearly, in the increasing order of height Neelam is in third position. Hence, the answer is (e).
2. Clearly in the descending order of ages, Neelam will be in fourth position (because Marina and Nazia both lie at third position).
3. Clearly I statement is not necessary. Hence, the answer is (a).

EXERCISE

Directions—(Q. 1-5): Read the following information and answer the questions given below it:

(i) Seven students P, Q, R, S, T, U and V take a series of tests.

(ii) No two students get similar marks.

(iii) V always scores more than P.

(iv) P always scores more than Q.

(v) Each time either R scores the highest and T gets the least, or alternatively S scores the highest and U or Q scores the least.

1. If S is ranked sixth and Q is ranked fifth which of the following can be true?
   (a) V is ranked first or fourth
   (b) R is ranked second or third
   (c) P is ranked second or fifth
   (d) U is ranked third or fourth
   (e) T is ranked fourth or fifth
2. If R gets the most, V should be ranked not lower than
   (a) Second (b) Third
   (c) Fourth (d) Fifth
   (e) Sixth
3. If R is ranked second and Q is ranked fifth, which of the following must be true?
   (a) S is ranked third (b) T is ranked sixth
   (c) P is ranked sixth (d) V is ranked fourth
   (e) U is ranked sixth
4. If S is ranked second, which of the following can be true?
   (a) U gets more than V (b) V gets more than S
   (c) P gets more than R (d) P gets more than V
   (e) T gets more than Q
5. If V is ranked fifth, which of the following must be true?
   (a) S scores the highest (b) R is ranked second
   (c) T is ranked third (d) Q is ranked fourth
   (e) U scores the least

ANSWERS

1.	(d)	2.	(c)	3.	(b)	4.	(a)	5.	(a)		

(5)

SEQUENTIAL ORDER OF THINGS

In this type of question, some hints are given regarding the occurrence of certain events. The candidate is required to go through the given information and make the right sense and then answer the pertaining questions accordingly.

Example: Read the following information carefully and answer the questions given below it.

(i) Eight doctors P, Q, R, S, T, U, V and W visit a charitable dispensary every day except on a holiday *i.e.*, Monday.

(ii) Each doctor visits for one hour from Tuesday to Sunday except Saturday. The timings are 9 A. M. to 1 P. M. and 2 P.M. to 6 P.M. to 2 P.M. is lunch break.

(iii) On Saturday it is opened only in the morning i.e., 9 A.M. to 1 P.M. and each doctor visits for only half an hour.

(iv) No other doctor visits the dispensary before doctor Q and after U.

(v) Doctor W comes immediately after the lunch break and is followed by R.

(vi) S comes in the same order as P in the afternoon session.

1. Doctors P visits in between which of the following pairs of doctors?

(a) S and V
(b) U and W
(c) R and W
(d) R and U
(e) None of these

2. At what time the visit of doctor R is over Sunday?

(a) 1 P.M.
(b) 3 P.M.
(c) 4 P.M.
(d) 5 P.M.
(e) None of these

3. At what time the visit of Doctor T would be over on Sunday?

(a) 10 A.M.
(b) 11 A.M.
(c) Either 10 A.M. or 11 A.M.
(d) Data inadequate
(e) None of these

If the lunch break and subsequent visiting hours are reduced by 15 minutes. At what time doctor U is expected to attend the dispensary?

(a) 3.15 P.M.
(b) 4 P.M.
(c) 4.15 P.M.
(d) 4-45 P.M.
(e) None of these

ANSWERS WITH EXPLANATION

We can make the time sequence by their visits using (iv), (v) and (vi).

It is clear that Q visits first and R visits last from (iv)

From (v), It is also clear that W visits first after break and is followed by R.

From (vi) We know that P visits after break means after W and R's visits.

Thus, the sequence of visits after lunch break will be WRPU.

Also, S has the same position in morning session as P in afternoon session means third in morning session.

The morning session sequence will be Q, T/V, S, V/T because the position of V and T is not clear.

1. (d) P visits between R and U.
2. (c) W visits between 2 to 3 P.M. and R visits between 3 P.M. to 4 P.M. Hence, the visits of R is over at 4 P.M.
3. (c) Clearly T visits either second or fourth. The time of visit on Saturday will be either 9-30 A.M. or 10-30 A.M. It means that T's visit will be over at either 10 A.M. to 11 A.M.
4. (b) As mentioned the time of lunch break is over and doctor W visits at 1-45 P.M., Doctor R will visit at 2-30 P.M., Doctor will visit at 3.15 P.M. and U will visit at 4 P.M.

EXERCISE

1. Five boys took part in a race. Raja finished before Fraz but behind Ghazanfar. Ashiq finished before Shahid but behind Fraz. Who won the race?

(a) Raja
(b) Ghazanfar
(c) Fraz
(d) Ashiq

Directions—(Q. 2-4): Read the following information carefully and answer the questions that follow:

Five plays A, B, C, D and E are to be staged from Monday to Friday of a week. On each day, only one play will be staged. D or E should not be either the first or last to be staged. E should be immediately followed by C. B should be staged immediately after D. One play is staged between A and B.

2. Which is the first play to be staged?

(a) A
(b) B
(c) C
(d) Cannot be determined
(e) None of these

3. Which of the following is the correct sequence of staging all the plays?

(a) ADBCE
(b) AECDB
(c) BDAEC
(d) DBECA
(e) None of these

4. Which play was staged on Wednesday?

(a) A
(b) B
(c) Either B or C
(d) Cannot be determined
(e) None of these

Directions—(Q. 5-9): Read the following information carefully and answer the questions that follow:

Six lectures-A, B, C, D, E and F are to be organised in a span of seven days from Sunday to Saturday. Only one lecture on each day in accordance with the following:

(i) A should not be organised on Thursday.

(ii) C should be organised immediately after F.

(iii) There should be a gap of two days between E and D.

(iv) One day there will be no lecture (Friday is not that day), just before that day D will be organised.

(v) B should be organised on Tuesday and should not be followed by D.

5. On which day there is no lecture?
   (a) Monday
   (b) Friday
   (c) Sunday
   (d) Cannot be determined
   (e) None of these

6. How many lectures are organised between C and D?
   (a) None
   (b) One
   (c) Two
   (d) Three
   (e) None of these

7. Which day will the lecture F be organised?
   (a) Thursday
   (b) Friday
   (c) Saturday
   (d) Sunday
   (e) None of these

8. Which of the following is the last lecture in the series?
   (a) A
   (b) B
   (c) C
   (d) Cannot be determined
   (e) None of these

9. Which of the following informations is not required in finding the complete sequence of organisation of lectures?
   (a) (i) only
   (b) (ii) only
   (c) (i) and (ii) only
   (d) (v) only
   (e) All are required

ANSWERS WITH EXPLANATION

1. b) The order is Ghazanfar, Raja, Fraz, Ashiq, Shahid. Hence, Ghazanfar race.

For Question No. 2 to 4.

Monday	Tuesday	Wednesday	Thursday	Friday
A	P	B	E	C

2. (a) A is the first play to be staged.
3. (e) The proper sequence is ADBEC.
4. (b) B was staged on Wednesday.

For Question No. 5 to 9.

From the statement, B is organised on Tuesday. B can not be followed by D. It means there are two days before B in which arty lecture can be possible but D is followed by the day with no lecture. It is clear that D will be organised on Sunday. There is a gap of two days between D and E. So E will be organised on Wednesday because A cannot be- organised on Thursday and C should be organised immediately after. Clearly F and C will be organised on Thursday and Friday respectively. Hence, A will be organised on Saturday. So, the correct sequence is

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
D		B	E	F	C	A

5. (a) No lecture on Monday.
6. (c) There are three lectures between C and D
7. (a) F is organised on Thursday.
8. (a) A is the last lecture.
9. (e) All the statements are required.

(6)

SELECTION BASED ON CERTAIN GIVEN PRE-CONDITIONS

This type of question is solved by keeping in mind various given pre-conditions and a few essential criteria for selection of group items. The candidate has to make the required selection as per the directions given in each question.

Example

Directions—(Q. 1-5): Study the following information carefully and answer the questions below.

A team of five is to be selected from amongst five boys A, B, C, D and E and four girls P, Q, R and S. Some criteria for selection are:

A and S have to be together
P cannot be put with R
D and Q cannot go together
C and E have to be together
R cannot be put with B

Unless otherwise stated, these criteria are applicable to all questions below:

1. If two of the members have to be boys, the team will consist of:
   (a) ABSPQ (b) ADSQR
   (c) BDSRQ (d) CESPQ
2. If R be one of the members, the other members of the team are:
   (a) PSAD (b) QSAD
   (c) QSCE (d) SACE
3. If two of the members are girls and D is one of the members, the members of the team other than D are:
   (a) PQBC (b) PQCE
   (c) PSAB (d) PSCE
4. If A and C are the members, the other members of the team cannot be:
   (a) BES (b) DES
   (c) ESP (d) PQE

5. If including P at least three members are girls, the members of the team other than P are—
   (a) QSAB
   (b) QSBD
   (c) QSCE
   (d) RSAD

ANSWERS WITH EXPLANATION

1. (a) If A is selected naturally S has to be selected.
   If B is selected R cannot be selected.
   If D is selected Q cannot be selected.

So, the options ADSQR and BDSRQ are wrong and CESPQ is not possible because S has to be accompanied with A.

2. (d) If R is selected P cannot be selected, therefore option PSAD is wrong.
   D and Q cannot go together. So, QSAD is wrong.
   S and A have to be together So, QSCE is wrong. Now, the team combination will be SACE
3. (c) If D is selected Q cannot be selected, therefore PQBC and PQCE are not correct. S and A have to be always together. Therefore, PSCE is wrong.
4. (d) If A and C are the members, S and E have to be selected. Therefore, option (d) PQE is not the correct combination.
5. (a)

EXERCISE

Directions—(Q. 1-3): Read the following information carefully and answer the questions given below it.

Eight students A, B, C, D, E, F, G and H are planning to enjoy car racing. There are only two cars and following are the conditions.

(i) One car can accommodate maximum five and minimum four students,
(ii) A will sit in the same, car in which D is sitting but H is not in the same car.
(iii) B and C cannot sit in the same car in which D is sitting.
(iv) F will sit in the car of four people only along with A and E but certainly not with G.

1. If H and G are sitting in the same car, who are other two students sitting in the same car?
   (a) B and C
   (b) C and D
   (c) B and D
   (d) E and B
   (e) None of these
2. If E and A are sitting in the same car, which of the following statements is true?
   (a) Five students are sitting in the same car
   (b) B is sitting in the same car
   (c) F is not sitting in the same car
   (d) G is not sitting in the same car
   (e) None of these

3. Which of the following statements is superfluous for the above sitting arrangements?

(a) Only (i)
(b) Only (ii)
(c) Only (iii)
(d) Only (iv)
(e) None of these

Directions—(Q. 4-8): Study the following information carefully and answer the questions that follow.

At an electric Data Processing Unit five out of the eight program sets P, Q, R, S, T, U, V and W are to be operated daily. On any one day except for the first day of the month only three of the program sets must be the ones that were operated on the previous day. The program operating must also satisfy the following conditions.

(i) If program P is to be operated on a day, V cannot be operated on that day.
(ii) If Q is to be operated on a day, T must be one of the programs to be operated after Q.
(iii) If R is to be operated on a day, V must be one of the programs to be operated after R.
(iv) The last program to be operated on any day must be either S or U.

4. Which of the following could be the set of program to be operated on the first day of the month?

(a) VQRTS
(b) UQSTW
(c) TURVS
(d) QSRVU
(e) PRVSU

5. Which of the following is true of any day's a valid program set operation?

(a) P cannot be operated at third place
(b) Q cannot be operated at third place
(c) R cannot be operated at fourth place
(d) T cannot be operated at third place
(e) U cannot be operated at fourth place

6. If R is operated at third place in a sequence, which of the following cannot be the second program in that sequence?

(a) Q
(b) S
(c) T
(d) U
(e) W

7. If the program sets R and W are to be operated on the first day which of the following could be the other programs on that day?

(a) P,T,V
(b) Q,V,S
(c) Q,T,V
(d) T,S,U

8. If the program sets operated on a day is P, Q, W, T, U each of the following could be the next day's program set except.

(a) W,T,U,V,S
(b) W,T,S,P,U
(c) W,R,V,T,U
(d) Q,T,V,W,S
(e) Q,R,V,T,U

ANSWERS WITH EXPLANATION

For Question No. 1 to 3.

There are two cars I and II.

A and D sit in the same car, means, in I car H cannot sit in the same car *i.e.*, H will sit in car IIB and C are not in the same car in which D is sitting *i.e.* B and C will sit in car II.

G is also in other car, means car IT.

Now, we have

Car I – ADEF Car II – BCGH

1. (a) B and C are in the same car in which G and H are there.
2. (d) Clearly G is not sitting.
3. (a) State I is superfluous, it is not necessary.

For Question No. 4 to 9.

4. (c)
5. (c) R cannot be operated at fourth place.
6. (a)
7. (e) Since R is operated, so V must also be operated.

Also, S or U is to Be taken at the end. Therefore, the possible combinations are QSV and TSV.

Now, Q must have also T as one of the program after it which is not possible. Hence. Q,S. V is incorrect.

8. (b)

CHAPTER 8

MENTAL ABILITIES

Definition: It may be defined as the capacity to perform the higher mental processes of reasoning, remembering, understanding and problem solving.

Psychologists have not reached a consensus on how best to define intelligence. Proposed definitions often focus on the role of intelligence in reasoning, problem solving, and dealing with the environment.

INTELLIGENCE AND THE DIVERSITY OF MENTAL ABILITIES

1. **The psychometric approach**
   - The psychometric approach attempts to analyze the structure of intelligence by examining correlations between tests and mental ability.
   - Because scores on almost all tests of mental ability are positively correlated, Spearman concluded that all of these tests measure a general factor of mental ability, called g-factor of intelligence.
   - Other researchers concluded that intelligence is not a single trait. It seems that g reflects a collection of sub-skills and mental abilities needed to succeed on any test of intelligence.
2. **The information-processing approach**
   - The information-processing approach focuses on the processes by which intelligent behavior is produced
   - Small positive correlations were found between IQ scores and measures of the flexibility and capacity of attention, and between IQ scores and the measures of the speed of information processing.
3. **Sternberg's Triarchical Theory**
   - According to Sternberg, intelligent thinking involves three kinds of mental processes
     - o Performance components – are the processes of perceiving stimuli, holding information in short-term memory, comparing values, retrieving material from long-term memory, and calculating sums and differences.
     - o Knowledge-acquisition components –-are processes used in gaining and storing new information.
     - o Metacomponents – are the processes that control performance and knowledge acquisition components; they determine the problem solving strategies people use.

- Sternberg consider that meta-components hold the greatest importance in intelligent cognitive activities
- Stenberg's triarchical theory also holds that intelligence depends on the ability to profit from experience and to deal with the environment.

4. **Multiple intelligences**

- Gardner's approach to intelligence is based not only on the result of mental tests and information-processing research but also studies of prodigies, human development, biology, and various cultures.
- Gardner holds that biology equips humans with the raw capacities for several intelligences that can function with some independence and specifically:
  - o Linguistic
  - o Logical-mathematic
  - o Spatial
  - o Musical
  - o Body-kinesthetic (demonstrated by the skills of dancers or athletes)
  - o Personal (refers to knowledge and understanding of oneself and of one's relations to others)

MATRIX FOR ANALYZING MENTAL ABILITIES

Approach	Method	Key findings
Psychometric	Define the structure of intelligence by examining factor analysis of the correlations between scores on tests of mental abilities.	Performance on many tests of mental abilities is highly correlated, but this correlation, represented by g, reflects a bundle of abilities, not just one trait
Information processing	Understand intelligence by examining the mental operations involved in intelligent behavior.	The amount of attentional resources available makes a significant contribution to performance on IQ tests. The speed of basic processes is somewhat less important.
Sternberg's triarchical theory	Understand intelligence by examining the information processing involved in thinking, changes with experience, and effects in different environments.	Thinking involves three components. High intelligence is shown in the effective organization of these components, in altering their use to deal with novel or familiar problems, and in adapting problem-solving strategies to different environments.
Gardner's theory of multiple	Understand intelligence by examining test scores, information	Biology provides the capacity for six distinct "intelligences"

intelligence	processing, biological and developmental research, the skills valued by different cultures, and exceptional people.	valued by society: linguistic, logical-mathematical, spatial, musical, body-kinesthetic, and personal.

- **CREATIVITY**
  - Tests of divergent thinking are used to measure differences in creativity
    - Divergent thinking is the ability to think along many paths to generate many solutions to a problem.
    - Divergent thinking tests are scored by counting the number of different but plausible responses that a person can list for each item.
  - In contrast, IQ tests require convergent thinking.
    - Convergent thinking is the ability to apply logic and knowledge in order to narrow down the number of possible solutions to a problem.
  - Although creativity and IQ scores are not highly correlated, creative behavior requires intelligence.
  - More specifically, the emergence of creativity requires expertise in a creative field, skills at problem solving and divergent thinking, and motivation to pursue a creative endeavor for its one sake.
- **Changes in mental abilities**
  - Cross-sectional and longitudinal studies are used to examine age-related changes in mental abilities.
  - IQ scores remain relatively constant throughout most adulthood, until the age of about sixty or seventy.
  - In old age some aspects of crystallized intelligence continue to grow, but fluid intelligence may decline.
    - Crystallized intelligence – depends on retrieving information and facts about the world from long-term memory
    - Fluid intelligence – involves rapid and flexible manipulations of ideas and symbols

SCALES FOR THE MEASUREMENT OF THE SPECIFIC CONSTRUCTS OF MENTAL ABILITIES

PART A

1. VERBAL ABILITY
2. MECHANICAL ABILITY
3. NUMERICAL ABILITY
4. SOCIAL ABILITY

NON-VERBAL ABILITIES BASED ON REASONING

PART B

I. VERBAL MENTAL ABILITY SCALE:

Word is the basis of language and indispensable to understand it. Therefore all competitive entrance examinations give an extra emphasis on word related problems. The main types of word problems in the examinations are:

1. Synonym
2. Antonym
3. Sentence completion (Fill in the blanks)
4. Analogy
5. Odd word out

It becomes desirable that the taker of these examinations start building his/her vocabulary at an early stage. A good vocabulary is very important for success in these examinations. In the course of discussing the above types of word problems, we will be suggesting you the ways to improve your vocabulary. The first and foremost method of improving vocabulary is reading books, magazines and newspapers. A word is complete and meaningful only when it is used in a sentence. The sentence brings forth the complete meaning of a word. Therefore, we will start our discussion of synonym and antonym with the contextual use of these words. In such questions you are required to find a synonym or antonym to an underlined or a bold word in the sentence.

Before we start our discussion of such questions, we would like to remind you that whenever a difficult word comes in the way of your reading a newspaper, a book or doing reading comprehension passages, first guess the meaning of the word in the context. then consult a dictionary and note down the word and its meaning in a note pad for revision. By practice, you can guess accurately and less and less use of dictionary would be required over time. The most important thing in such exercise is to first guess the general meaning the sentence conveys and then replace the underlined word with another meaningful word in the context. You need to look for a similar word in the option. You will be required to eliminate those choices which are clearly different. Before you tick your answer finally, check your choice by putting it in place of the underlined word and reading the sentence. The word should be meaningful in the sentence. The idea of choosing a correct word for a context can be better understood if we consider some examples.

Synonym in Context Directions—Choose the synonym from the four options for the underlined word in the sentence. Example 1. Cacophony: Quarrelling people created a lot of cacophony and so nobody was able to hear us. (a) fighting (b) hearing (c) noise (d) bitterness Explanation What quarrelling or fighting or arguing people produce or create that makes hearing impossible ? They created what ? The correct answer is (c) noise.

Antonym in Context—The exercise on synonyms has made this clear to you how to locate a correct answer. In case of antonyms, you have to first replace the underlined word with an easier word and then make negative of the word by adding 'no' or 'not' to it. Read the sentence again with the negative word. Then. look for the word in the choices that can fit in the sentence without changing its meaning in the negative sense. Follow the procedure explained below in finding antonyms to a word in a given context. Directions Guess the meaning of the underlined words in the context and choose the antonym for the same.

Example 1. Diligent: The student's constant and diligent efforts brought him great success. (a) lucky (b) constant (c) lazy (d) slow Explanation 'Constant and diligent' can be read as 'constant and labourious' and converted into negative as 'constant but not labourious'. Another word for 'not laborious' is lazy. The correct answer is (c) lazy.

Synonym and Word Root—The big words that we read today are developed from very small parts of them. These small parts are still there in the word and are called roots. From one common root, many words have been derived over time and all these words belong to the same root family. These words are not exactly similar in meaning but they have some common hidden similarity. This similarity helps us to know the meaning of the words and remember them. Therefore, knowing the roots of words of the same family is a very effective way of learning and retaining words for long. As the contextual understanding and elimination of options is helpful in solving synonym and antonym questions, knowing the root of the word is also very helpful, especially when the questions are without context. The very big words like intimidation, congregation, circumambulate or incontrovertible are reduced to their roots such as tim, greg, amble and contra. You need to know their meaning such as tim means fear as in timid, that is, fearful. Another similar word is timorous. By adding prefix in and suffix ation, the word becomes intimidation meaning to frighten, to terrorise. Similarly, the root greg means group or gather and the word congregation means to gather together. Amble means to walk or move and contra means opposite or against. The word circumambulatory means to take or walk through a very long or indirect path and incontrovertible means the one that cannot be contradicted or disputed. You need to know the roots of certain words before you can use the skill effectively in synonym and antonym exercises. In the following examples, first see how the root makes a relation among all the words of its family and then understand the special meaning of the word. Finally, notice how the knowledge of root words is applied in synonym questions. Directions In the following examples learn the words before you go through the solved questions.

Example 1. cognosc/gnosi = know • recognize = to know again, to identify, to recognize a very old friend.

Antonym and Word Root: In order to find the antonym of the given word, first make sure the meaning of the word with the help of its root and think of an opposite word. To do so either add a negative prefix like a, un, in, im or no or not at the beginning of the word. Then, match your negative word with the given answer choices. Directions In the following examples learn the words before you go through the solved questions.

Example 1. Fid = trust • fidelity = loyalty, trustworthiness • confident = trust in oneself • diffident = lack of trust in oneself • infidelity = being disloyal to one's husband or wife • infidel = non believer in one's religion

Synonym and Prefix: Some prefixes render negative meaning to a word. If you can identify a word with such prefixes in the question stem, you will immediately get to know what kind of word you have to look for in the answer stem. The synonym of a word with negative prefix will have to be negative in meaning and the antonym of a word with negative prefix will have to be positive in meaning. Let us see what these prefixes are and what kind of words they form. Prefix Meaning Word Meaning ab away from abject abduct hopeless, very bad kidnap an without anarchy anachronism lawlessness dated wrongly anti against anti-government antipathy forces against government feeling against, hostility contra against contradict controversy to say or go against dispute dis not disqualified dislike not remaining qualified not like il/in/im/ir not illegal insufficient impossible irrelevant not legal not sufficient or enough not possible not relevant or suitable mis wrong misspell misplaced wrongly spell placed or kept wrongly non not nonentity noncommittal unimportant person undecided ob/op against object obnoxious opposition to be against extremely unpleasant opponent against re against, back reject retreat disapprove move back un not unpleasant unwanted not pleasant not wanted, unwelcome Directions Choose the synonym for the given word.

Synonym and Odd Word Out Odd word out is another category of word problem which the examinees may face in an MBA entrance examination. In a cluster of four words, one word is odd. It means three of them are alike. In a synonym problem, three will be synonyms and one will be odd. Therefore, if a candidate can identify at least two alike or synonymous words, it would become an easier task for him. He needs to establish the relation between the two words and check which one of the remaining does not follow the same relation. In the following cluster of words, identify two similar words: (a) amusing (b) hilarious (c) humorous (d) dull Explanation Let us assume you know that amusing and entertaining are similar and their relation is that both mean something pleasing to mind. In such a case, you have to check the word out that does not mean pleasing to mind. For sure you can say it is dull that does not please your mind. You can go for this choice even if you don't know the meaning of hilarious and humorous. Thus, the answer is (d) dull.

2. MECHANICAL REASONING

Mechanical reasoning tests measure your knowledge of straightforward mechanical and physical concepts. They do not measure your underlying mechanical aptitude in the same way that abstract reasoning questions measure your underlying intellectual ability. For example, you could sit an abstract reasoning test without having seen one before and still get a reasonable score. The same is not true of mechanical reasoning where your score will depend significantly on your knowledge of:

- Levers
- Pulleys
- Gears
- Springs
- Simple Electrical Circuits
- Tools
- Shop Arithmetic

You may have come across: levers, pulleys, gears, springs and simple circuits in elementary science and the questions on these topics are fairly straightforward. If elementary science classes seem like a long time ago and you need to refresh your memory then read *'Mechanical Reasoning Tests—What You Need to Know'* before you attempt these practice tests.

If you are taking a test as part of the selection for a craft or apprenticeship job, then you may be asked some questions about tools and how they are used. These questions are again straightforward and if you have spent significant time fixing or making things, they won't present any problems.

However, mechanical goods of all types are relatively cheaper, less prone to breakdown and often less repairable than they were 20 years ago. This means that many people under 30 years of age don't have much practical experience of fixing things or of watching someone else do so. If you feel that this applies to you, then you will need to make some effort to improve your knowledge of everyday tools. You can do this by getting hold of a catalog for a tool hire company and simply reading through it-boring but effective.

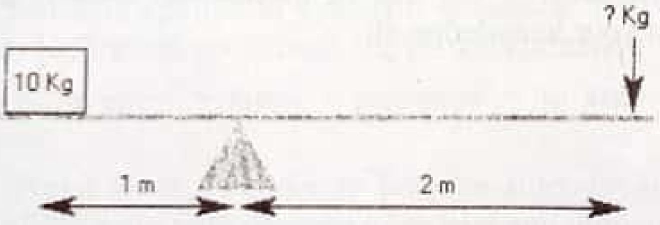
If you are taking a test as part of the selection for a craft or apprenticeship job you should also expect some shop arithmetic questions. These questions approximate the type of reasoning and maths that are needed to estimate materials costs etc. You will need to know the formulae for calculating the areas and volumes of simple shapes, as well as familiarity with imperial units including: inches, feet and yards. For example, you need to know that there are nine square feet in a square yard, something which surprises many people brought up using only metric units! These are again dealt with in *'Mechanical Reasoning Tests—What You Need to Know'*.

One final point, many of the questions in mechanical reasoning tests are 'industry' specific. For example, tests used by the fire service tend to frame the questions in terms of fire-fighting whereas tests used to select for an aircraft maintenance job would tend to frame the questions in aviation industry terms. It doesn't matter if the questions you practice on aren't specific to the industry you are applying for. It is the substance of the question that is important—the scenario is incidental.

TEST 1 — 10 QUESTIONS

Answer as many questions as you can in 15 minutes. Circle the letter below the question which corresponds to the correct answer. You are advised to use a calculator.

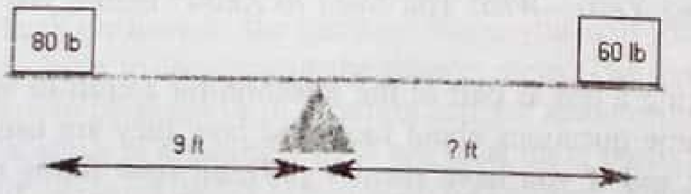
1. **How much weight is required to balance the lever?**



A	B	C	D	E
15K	5Kg	10Kg	7.5Kg	20Kg

A B C D E

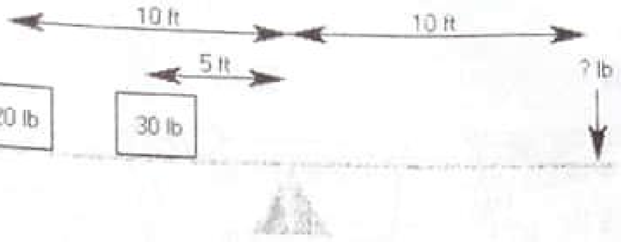
2. **How far from the fulcrum does the 60 lb weight need to be to balance the lever?**



A	B	C	D	E
9 ft	7 ft	14 ft	12 ft	10 ft

A B C D E

3. **How much weight is required to balance the lever?**



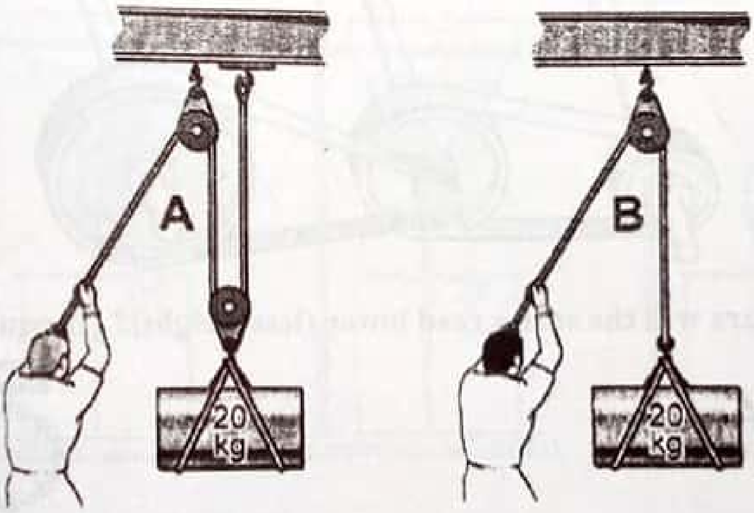
A	B	C	D	E
30 lbs	25 lbs	28 lbs	40 lbs	35 lbs

A B C D E

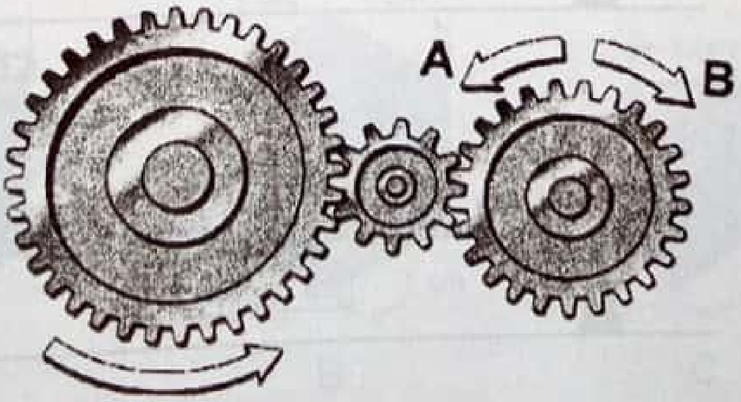
SAMPLE MECHANICAL REASONING TEST

This is a sample test for you to get prepared for the 'real' Mechanical Reasoning test for BCIT Trades Programs. (Test has 70 questions with a time limit of 60 minutes).

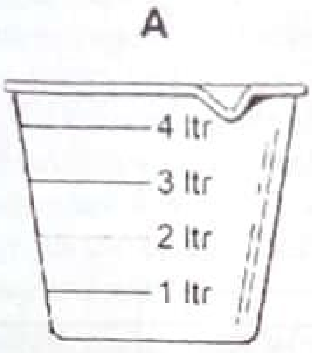
1. **Which person must pull harder to lift the weight? (If no difference, mark C.)**

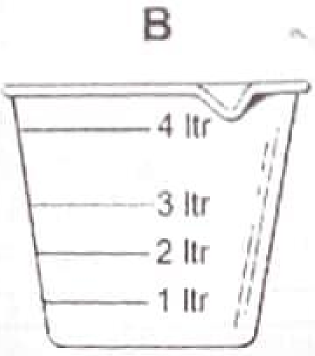


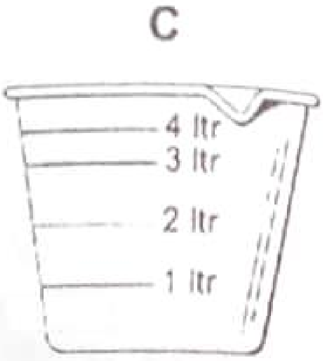
2. **When the left-hand gear turns in the direction shown, which way does the right-hand one turn? (If either, mark C.)**



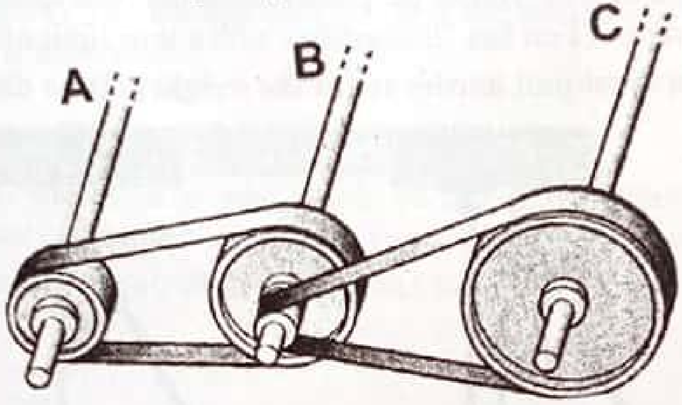
3. **Which measure is marked properly?**



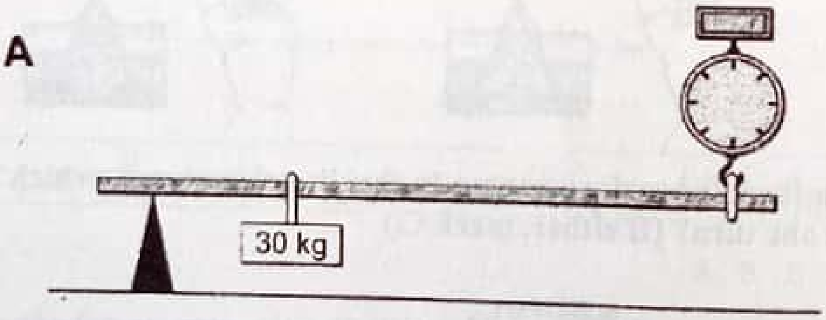


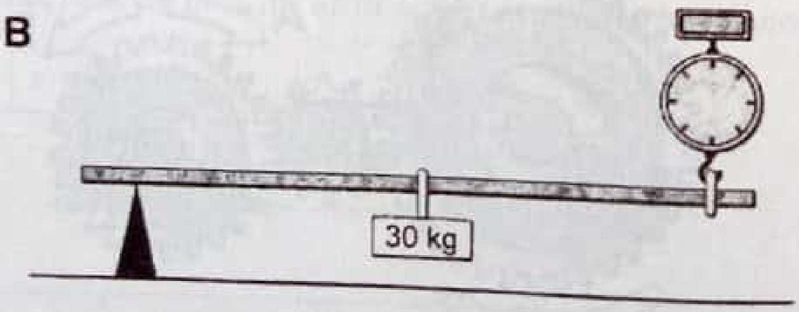


4. **Which shaft will turn most quickly?**

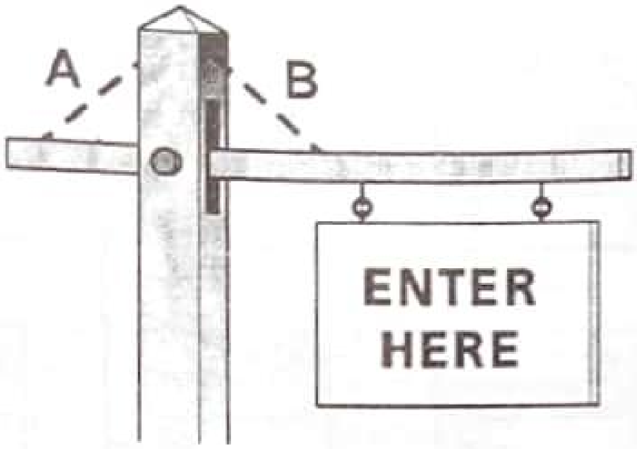


5. **In which picture will the scales read lower (less weight)? (If equal mark C.)**



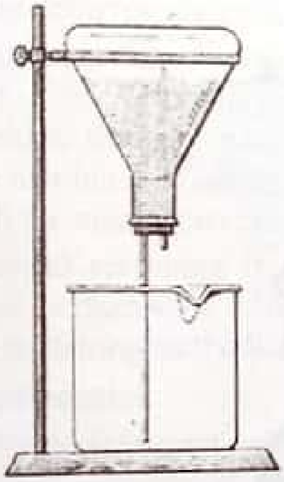


6. **Where should a chain be attached to hold up the sign? (If either, mark C.)**

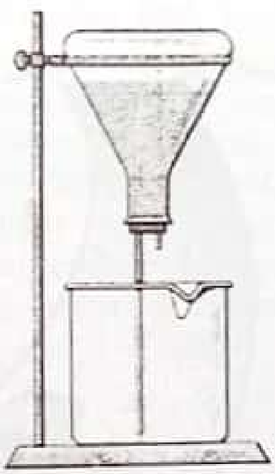


7. **Which system will let the most water run out?**

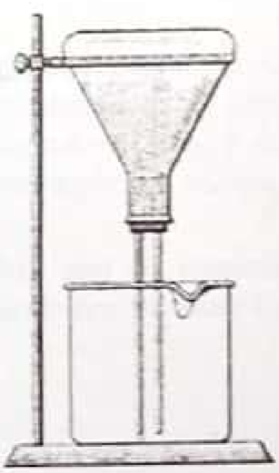
A



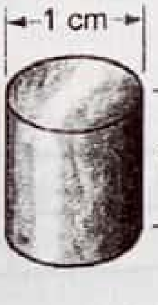
B



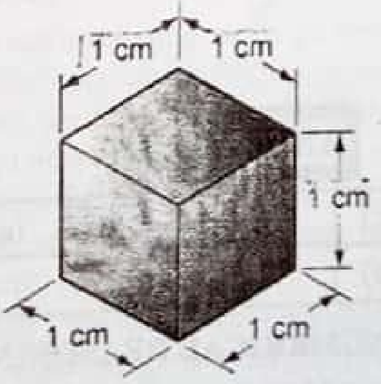
C



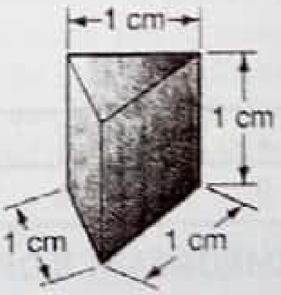
8. **Which weight most?**



A



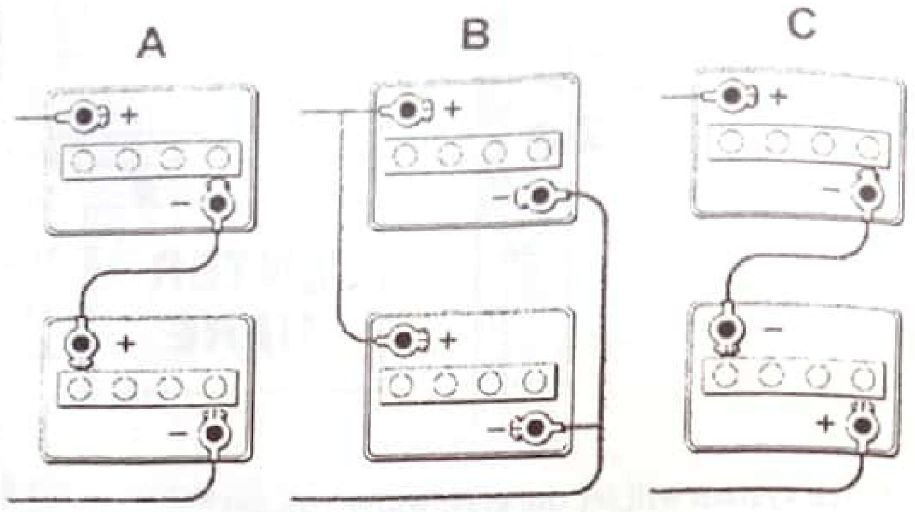
B



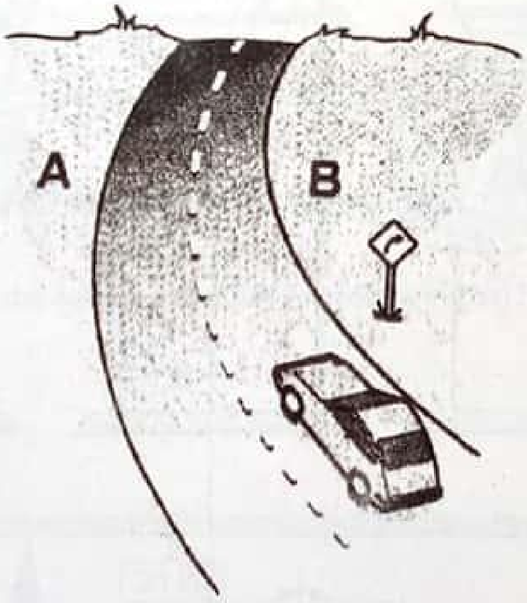
C

9. Which diagram shows two 6-volt batteries connected to give 12 volts?

9



10. **Off which side of the road is the car least likely to skid? (If no difference, mark C.)**



ANSWERS

1.	(b)	2.	(a)	3.	(c)	4.	(a)	5.	(a)	6.	(b)	7.	(b)
8.	(b)	9.	(a)	10.	(b)								

3. THE IMPORTANCE OF NUMERICAL REASONING

The ability to think critically and use numerical reasoning skills has become much more important in the workforce in recent years. To that end, psychometric testing can be a big help in determining whether a given individual has what's needed for a specific position, by measuring the following applicant characteristics:

- Skills
- Abilities
- Personality types

Numerical reasoning ability is one of the most basic skill areas, one that exists in small children well before they are taught mathematics in school. Numerical reasoning tests, also known as data interpretation or numerical critical reasoning tests, involve evaluating situations and drawing conclusions from the data provided to assess one or several of the following:

- Critical thinking ability
- Basic or general arithmetic operations
- Ability to perform estimates
- Ability to analyze graphs and other data
- Level of speed in making analyses or assessments
- Level of concentration in solving problems

It's considered to be one of the most basic skills needed in today's data-driven marketplace, and without strong numerical reasoning skills, it would be difficult to succeed in many jobs today. Many fields benefit from this type of testing, including most clerical and administrative jobs, jobs found in the craft and technical field at any level, and even positions in police or fire departments, or in the military field.

Assessments that measure job applicants' ability to use and respond to numerical data in the context of the work environment are the best way to measure these important skills. Along with critical thinking, numerical reasoning ability is considered to be a very important skill for close to a hundred occupations, from accountant to management analyst, as well as a necessary skill for many other positions.

Numerical reasoning is a higher-order thinking skill and an important factor in assessing work performance. Usually, numerical thinking skills are measured using one or several of the following methods:

- Arithmetics
- Graph interpretation
- Manipulating data
- Patterns and relevant information
- Table interpretation

Higher-order numerical reasoning skills go beyond traditional arithmetic skills such as adding, subtracting, multiplying, and dividing. Interpreting data provided in graphs and charts involves understanding the data presented and then being able to manipulate or apply that information. Careful and accurate comprehension of the data, regardless of the format it may be presented in, is the key. Deciphering patterns and determining relevant information is another aspect of numerical reasoning that is very useful in jobs involving analysis and making predictions of any sort.

Many people who don't use numerical operations very often feel intimidated by these types of tests. What you need to remember is that you don't need a high level of mathematical study to get a good result in these tests, because basically they measure your reasoning abilities and not your mathematical knowledge, and remember also that your test performance can surely be improved through practice.

VERBAL REASONING

This online test consists of ten multiple choice objective questions with answers. Simply select one of the answer choices. Your answer will be marked immediately by indicating ✓ or ✗. Also, the correct answer will be highlighted in green colour, if you prefer, you also have a choice to print these questions and work out at your convenient time.

Once you have answered all the ten questions in this online test, you can get your score for this test and the total score for all the tests you attempted today. You can get these scores by clicking the "Show Score" button.

In each of the following questions, various terms of an alphabet series are given with one or more terms missing as shown by (?). Choose the missing terms out of the given alternatives.

ANSWERS WITH EXPLANATION

1. BMO, EOQ, HQS ?

(a) KSU (b) LMN (c) SOV (d) SOW

Ans. **(a)**

The first letter moves 3 steps forward. The second and third letters move 2 steps forward.

2. AC, FH, KM, PR, ?

(a) UW (b) VW (c) UX (d) TV

Ans. **(a)** A. The letters move 5 steps forward.

3. R, P, N, L, ?, ?

(a) J, G (b) J, H (c) K, H (d) K, I

Ans. **(b)** The letters move 2 steps backward.

4. R, U, X, A, D ?

(a) F (b) G (c) H (d) I

Ans. **(b)** The letters move 3 steps forward.

5. B. E, D, F, ?, H, J, ?, L

(a) I, M (b) M, I (c) I, N (d) J, M

Ans. **(a)**

Divide the series into groups of three letters each. In each group, the second letter is 3 steps ahead of the first letter; the third letter is 2 steps ahead of the first letter.

6. M, N, O, L, R, I, V, ?

(a) A (b) E (c) F (d) H

Ans. **(b)**

The sequence is a combination of two series with the alternate letters. In the first series (M, O, R, V), the letters move 2, 3, 4, ... steps forward. In the second series (N, L, I), the letters move 2, 3, 4, ... steps backward.

7. Y, B, T, G, O, ?

(a) N (b) M (c) L (d) K

Ans. **(c)**

The sequence consists of two series (Y, T, O) and (B, G, ?). The first series consists of 2nd. 7th and 12th letters from the end of English alphabet. The second series consists of 2nd. 7th and 12th letters from the beginning of English alphabet.

8. **BD, GI, LN, QS, ?**

(a) TV (b) UW (c) WX (d) VX

Ans. **(d)**

Each term consists of two alternate letters. There is a gap of two letters between the last letter of each term and the first letter of the next term.

9. **CE, GI, KM, OQ, ?**

(a) TW (b) TV (c) SU (d) RT

Ans. **(c)**

Each term consists of two alternate letters. The last letter of each term and the first letter of the next term are alternate.

10. **BF, CH, ?, HO, LT**

(a) DN (b) EL (c) EK (d) EM

Ans. **(c)**

The first letter moves 1, 2, 3, ... steps forward. The second letter moves 2, 3, 4, ... steps forward.

NUMERICAL REASONING

This online test consists of ten multiple choice objective questions with answers. Simply select one of the answer choices. Your answer will be marked immediately by indicating ✓ or ×, Also, the correct answer will be highlighted in green colour. If you prefer, you also have a choice to print these questions and work out at your convenient time.

Once you have answered all the ten questions in this online test, you can get your score for this test and the total score for all the tests you attempted today. You can get these scores by clicking the "Show Score" button.

1. **In each of the following questions a number series is given with one term missing. Choose the correct alternative that will continue the same pattern and fill in the blank spaces.**

2, 7, 14, 23, ?, 47

(a) 31 (b) 28 (c) 34 (d) 38

Ans. **(c)**

The given sequence is +5, +7, +9, —

i.e. 2 + 5 = 7, 7 + 7 = 14, 14 + 9 = 23

Missing Number = 23 + 11 = 34.

2. **4, 6, 12, 14, 28, 30, ?**

(a) 32 (b) 64 (c) 62 (d) 60

Ans. **(d)**

The given sequence is a combination of two series 4, 12, 28. ,..., and 6, 14, 30, ... The pattern is +8, +16, +32. So, the missing number = (28 + 32) = 60

3. **4, 9, 13, 22, 35, ?**

(a) 57 (b) 70 (c) 63 (d) 75

Ans. (a)
Sum of two consecutive numbers of the series gives the next number.

4. **11, 13, 17, 19, 23, 29, 31, 37,41, ?**
(a) 43 (b) 47 (c) 51 (d) 53

Ans. (a)
The series consists of prime numbers.

5. **15, 31, 63, 127, 255, ?**
(a) 513 (b) 511 (c) 523 (d) 517

Ans. (b)
Each number is double of the preceding one plus 1.

6. **5, 11. 17, 25, 33, 43, ?**
(a) 49 (b) 51 (c) 52 (d) 53

Ans. (d)
The sequence is +6, +6, +8, +8, +10, …..

7. **9, 12, 11. 14, 13, ?, 15**
(a) 12 (b) 16 (c) 10 (d) 17

Ans. (b)
Alternatively, 3 is added and one is subtracted.

8. **0.5, 0.55, 0.65, 0.8, ?**
(a) 0.7 (b) 0.9 (c) 0.95 (d) 1

Ans. ( )

9. **1, 4, 9, 16, 25, ?**
(a) 35 (b) 36 (c) 48 (d) 49

Ans. (b)
The sequence is a series of squares, $1^2, 2^2, 3^2, 4^2, 5^2$.

10. **2, 1. $(\frac{1}{2}), (\frac{1}{4})$, ?**
(a) $\left(\frac{1}{3}\right)$ (b) $\left(\frac{1}{8}\right)$ (c) $\left(\frac{2}{8}\right)$ (d) $\left(\frac{1}{16}\right)$

Ans. (b)
This is a simple division series; each number is one-half of the previous number.

APTITUDE TEST: ARITHMETIC APTITUDE/NUMERICAL REASONING

Ten multiple choice questions to complete in 15 minutes

This online test consists of ten multiple choice objective questions with answers. Simply select one of the answer choices. Your answer will be marked immediately by indicating V or X. Also, the correct answer will be highlighted in green colour. If you prefer, you also have a choice to print these questions and work out at your convenient time.

Once you have answered all the ten questions in this online test, you can get your score for this test and the total score for all the tests you attempted today. You can get these scores by clicking the "Show Score" button.

MULTIPLE CHOICE QUESTIONS

1. **If 30% of a number is 12.6, find the number?**

(a) 45 (b) 38 (c) 40 (d) 42

Ans. **(d)**

2. **What number must be added to 6, 16 and 8 to get an average of 13?**

(a) 22 (b) 25 (c) 20 (d) 18

Ans. **(a)**

3. **What is the ratio of 12 minute to 1 hour ?**

(a) $\frac{2}{3}$ (b) $\frac{3}{4}$ (c) $\frac{1}{5}$ (d) $\frac{1}{4}$

Ans. **(c)**

4. **10 cats caught 10 rats in 10 seconds. How many cats are required to catch 100 rats in 100 seconds?**

(a) 100 (b) 10 (c) 20 (d) 50

Ans. **(b)**

5. **A man wants to reach a window which is 40 feet above the ground. The distance from the foot of the ladder to the wall is 9 feet. How long should the ladder be?**

(a) 9 feet (b) 81 feet (c) 41 feet (d) 49 feet

Ans. **(c)**

6. **There are eight mango trees in a straight line. The distance between each mango tree with other is 3 metres. What is the distance between first tree and eighth tree?**

(a) 24 m (b) 27 m (c) 30 m (d) 21 m

Ans. **(d)**

7. **4 men & 6 women can complete a work in 8 days, while 3 men and 7 women can complete it in 10 days. In how many days will 10 women complete it?**

(a) 35 days (b) 40 days (c) 30 days (d) 25 days

Ans. **(b)**

8. **A student is ranked 13th from right and 8th from left. How many students are there in total?**

(a) 18 (b) 19 (c) 20 (d) 21

Ans. **(c)**

9. **A goat is tied to one corner of a square plot of side 12m by a rope 7m long. Find the area it can graze?**

(a) 155 sq. m (b) 19.25 sq. m (c) 144 sq. m (d) 38.5 sq.m

Ans. **(d)**

10. **A father is 30 years older than his son. He will be three times as old as his son after 5 years. What is the father's present age?**

(a) 35 (b) 45 (c) 40 (d) 30

Ans. **(c)**

SOLVED EXAMPLES

Questions (1-5)

Directions: These questions consist of a number series which contains a wrong term. This term is given as one of the four alternatives among the four numbers given below. The wrong term is

1. **6, 8, 9, 12, 14, 18, 22, 26, 30**

(a) 12 (b) 22 (c) 26 (d) 30

Ans. **(b)**

Sol. ∵ 6, 9, 14, 21, 30 makes a rule

6 + 3 = 9
9 + 5 = 14
14 + 7 = 21
21 + 9 = 30
22 is wrong ans.

2. **3, 7, 9, 28, 27, 84, 81, 448, 243**

(a) 84 (b) 81 (c) 28 (d) 7

Ans. **(a)**

Sol. Two series Ist is: 3, 9, 27, 81, 243

3 × 3 = 9
9 × 3 = 27
27 × 3 = 81
81 × 3 = 243
Second series: 7, 28, 84, 448,
7 × 4 = 28
$\boxed{28 \times 4 = 112}$
112 × 4 = 112
∴ 84 is wrong ans.

3. **190, 94, 46, 22, 10, 4, 3**

(a) 94 (b) 46 (c) 22 (d) 3

Ans. **(d)**

Sol. 190, 94, 46, 22, 10, 4, 3
96 48 24 12 6 1

96 ÷ 2 = 48
48 ÷ 2 = 24
24 ÷ 2 = 12
12 ÷ 2 = 6
6 ÷ 2 = 3
∴ Last difference is 3 but difference by question is 1
∴ 4 – 3 = 1
∴ Last term 3 is wrong

4. 0, 5, 8, 17, 35, 65, 128
(a) 5 (b) 17 (c) 35 (d) 128

Ans. (c)

5. 9, 63, 5, 35, 1, 8
(a) 63 (b) 5 (c) 35 (d) 8

Ans. (d)

Sol. Two series

$$\begin{tikzcd}[row sep=small] \underbrace{9,\ 5,\ 1}_{-4,\ -4}\ \&\ 63, \arrow[d] & 35, \arrow[d] & 8 \arrow[d] & \text{it should be} \\ 8^2-1 & 6^2-1 & 4^2-1 & \end{tikzcd}$$

∴ 8 is wrong.

Questions (6-9)

Directions: Each question consists of four groups. One set is different from other three in someway. Find out the different set

6. (a) **GEDC** (b) **AZYX** (c) **PNML** (D) **USRQ**

Ans. (b)

Sol. Difference between letters is different.

7. (a) **SUXB** (b) **LNQU** (c) **BDGK** (d) **JLNQ**

Ans. (d)

Sol. Difference is different from all others.

8. (a) **23** (b) **43** (c) **63** (d) **73**

Ans. (c)

Sol. It is non-prime.

9. (a) **Hut** (b) **Home** (c) **Palace** (d) **Restaurant**

Ans. (d)

Questions (10-14)

Directions: In the following questions there is a letter series with one term missing shown by (?). Find this term and encircle its serial-

10. **DOZ, GRC, (?), ALW, BMX**
(a) BGL (b) LWH (c) DLT (d) GJM

Ans. (b)

Sol. Difference between each latter is 11

11. **fed, ihg, lkj, (?), rqp**
(a) npq (b) onm (c) oqp (d) nom

Ans. (b)

12. **ABYZ, ADWZ, (?), AHSZ**
(a) AFUZ (b) AUFZ (c) ZFUA (d) ZUFA

Ans. (a)

13. **VTRP, NLJH, FDBZ, XVTR, (?)**
(a) JLPN (b) LJPN (c) NPLJ (d) PNLI

Ans. [4]

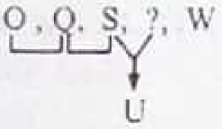
Sol. Rule in each option; from reverse alternate letters.

14. **OBDR, QACT, SZBV, (?), WXZZ**

(a) WUWZ (b) YTVB (c) UYAX (D) ASVD

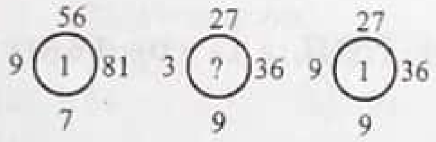
Ans. (c)

Sol. First letter of each word



Questions (15-18)

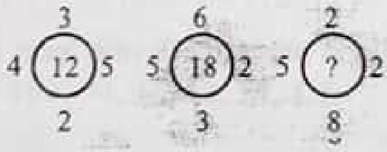
Directions: In each question there are circles. Certain numbers are given inside/outside the circles according to a particular rule. In each question one of the circle has a (?) mark in side it. Choose the correct answer to fill in the space marked (?) from the given alternatives.

15.


(a) 9 (b) 10 (c) 11 (d) 12

Ans. (a)

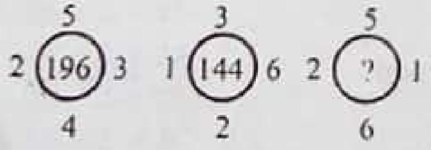
Sol.
$$\frac{81}{9}-\frac{56}{7}=1$$
$$\frac{36}{9}-\frac{27}{9}=1$$
$$\frac{36}{3}-\frac{27}{9}=9$$

16.


(a) 12 (b) 14 (c) 16 (d) 20

Ans. (c)

Sol. ? = without 0 of $(5 \times 2 \times 2 \times 8) = 16$

17.


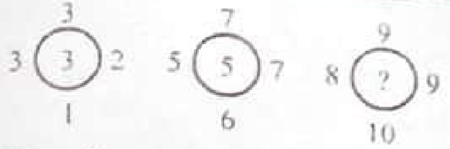
(a) 270 (b) 196 (c) 256 (d) 320

Ans. (b)

Sol. $196 = (2+4+3+5)^2$

$144 = (1+2+3+6)^2$

$? = (2+6+1+5)2 = (14)^2 = 196$

18. 

(a) 3 (b) 4 (c) 5 (d) 6

Ans. (d)

Sol. $? = \sqrt{8+9+9\div10} = 6$

Questions (19-21)

Directions: These questions are based on letter series in which some of the letters are missing. The missing letters are given in the proper sequence in one of the alternatives among the four given under each question. Find out the correct alternatives for each question.

19. __ **ab** __ **a** __ **bb** __ **ab** __ **a** __

(a) abaaba (b) babbba (c) aabbab (d) bbaabb

Ans. (a)

20. __ __**a bb** __ **bba** __ **bab** __ **a** __

(a) abaaba (b) aabbaa (c) bbabbb (d) bbaabb

Ans. (c)

21. __ **ac** __ **ca** __ **aca** __ **a** __ **a** __

(a) cacaca (b) aaaccc (c) acacac (d) cacccc

Ans. (d)

Questions (22-26)

Directions: Out of nine cells of a square one cell is left blank, and in the rest of the cells numbers are written which follow some rule. Get the rule and find out the proper option for the blank cell (?).

22.

4	9	20
8	5	14
10	3	?

(a) 8 (b) 11 (c) 14 (d) 15

Ans. (a)

Sol. $4+9+20=33$ 6
$8+5+14=27$
$10+3+8=21$ 6

23.

?	1	1
9	4	4
2	3	5

(a) 8 (b) 10 (c) 14 (d) 16

Ans. (b)

24.

8	10	9
?	15	28
7	12	13

(a) 9 (b) 10 (c) 11 (d) 12

Ans. (a)

25.

36	43	49
55	?	9
17	30	169

(a) 49 (b) 58 (c) 76 (d) 77

Ans. (b)

26.

5	8	7
11	17	15
21	33	?

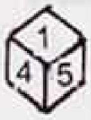
(a) 29 (b) 31 (c) 33 (d) 38

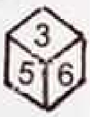
Ans. (a)

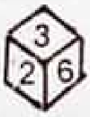
Questions (27-30)

Direction: Find out the correct alternative of the question based on the Dias figures.

27.





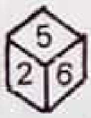


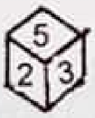
The number opposite side the face having the no. 5 will be

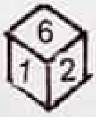
(a) 1 (b) 2 (c) 3 (d) 4

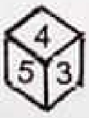
Ans. (b)

28.







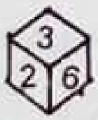


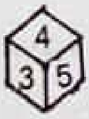
The number opposite the face having the no. 2 will be

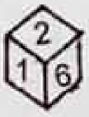
(a) 1 (b) 4 (c) 3 (d) 5

Ans. (b)

29.







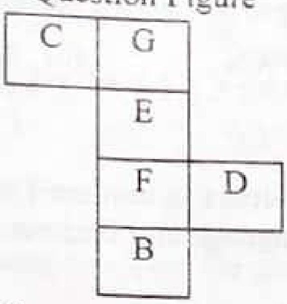
The number opposite the face having the no. 3 will be

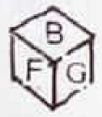
(a) 1 (b) 3 (c) 4 (d) 6

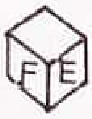
Ans. (a)

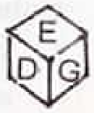
30. **The following figures are converted into a cube. Its incorrect shape will be**

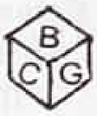
Question Figure



(a)


(b)


(c)


(d)


Ans. (b)

Questions (31-35)

Direction: The following questions are based on the arrangement of alphabets in the form of a pyramid. In each question there is some relationship between the two sets of the letters on the left of the (: :). The same relationship exists between the two terms on the right of which one is missing. Find the missing. Find the missing one from the given alternatives.

A
B C D
E F G H I
J K L M N O P
Q R S T U V W X Y

31. **BCG : DCG : : EGU : ?**

Ans. (a)

32. **EJQ : FKR : : HOX : ?**

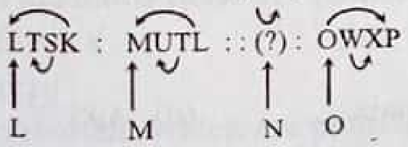
Ans. (b)

33. **LTSK : MUTL : : (?) : OWXP**

(a) LTUM (b) NMUV (c) NVWO (d) NOWV

Ans. (c)

Sol.

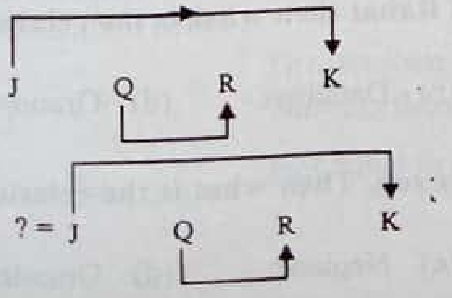


34. (?) : KRSL : : PYXO : OXWN

(a) RSLK (b) JQRK (c) JKRQ (d) QRKJ

Ans. (b)

Sol.



35. **JQS : PWY : : KRT : (?)**

(a) OVX (b) PWN (c) OWY (d) VOX

Ans. (a)

Questions (36 – 43)

Direction: Words in Capital letters in column-I are written in small letters in a code language in column-II. Decode the language and find out the correct alternative for the given letters in each question.

Column–I	Column–II
HOPE	vtyg
WIDE	ceth
LUCK	nxfl
DUST	aien
SIND	cmae
SOAP	gapv
FEAR	putj
MUST	nidg
HUNT	mnyi
FILE	cxut
PINE	cmtg

36. **Code for letters in the word SOLE are**

(a) txza (b) tvxy (c) mtax (d) vtax

Ans. (d)

37. **Code for letters in the word MENT are**

(a) ndti (b) dtum (c) mdit (d) puit

Ans. (c)

38. **Code for letters in the word NEWS are**

(a) hmta (b) tmkh (c) fmak (d) tahv

Ans. (a)

39. **Code for letters in the word STAR are:**

(a) ipaj (b) jami (c) paiz (d) ajkl

Ans. (a)

40. **Code for letters in the word TIME are:**

(a) tkci (b) citd (c) ctpb (d) litm

Ans. (b)

41. **Rahat is father of 'B' but 'B' is not son of Rahat then what is the relationship of 'B' to Rahat?**

(a) Grand-daughter (b) Mother (c) Daughter (d) Grand-son

Ans. (c)

42. **Akram is the brother of the son of Azam's son. Then what is the relationship of Akram to Azam?**

(a) Brother (b) Cousin (c) Nephew (d) Grandson

Ans. (d)

43. **How many '6' s are there in the following sequence which are followed by 3 and preceded by 8?**

9 4 8 6 3 2 7 1 8 6 8 9 8 1 3 6 8 9 7 8 6 3 1 3 6 8 4 3 2 3 5

(a) 2 (b) 3 (c) 4 (d) 5

Ans. (a)

Questions (44-45)

Direction: Find out the missing one from the given alternatives.

44. **03 : 10 : : 08 : (?)**

(a) 17 (b) 16 (c) 14 (d) 13

Ans. (a)

Sol. $2^2 - 1 : 3^2 + 1 :: 3 - 1 : \underset{\substack{\downarrow \\ 17}}{4^2 + 1}$

45. **01 : 08 : : (?) : 125**

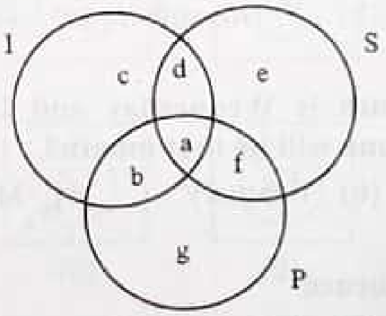
(a) 10 (b) 12 (c) 15 (d) 16

Ans. (d)

Sol. $1^2 : 2^3 :: 4^2 : 5^3$

Questions (46-47)

Directions: In the following diagram "I" represents Pakistanis 'S' represent Scientists and 'P' represents Politicians.



46. **Pakistanis those are politicians but not scientist will be**

(a) a (b) b (c) d (d) f

Ans. (c)

47. **Scientists which are politician but not Pakistanis will be**

(a) d (b) e (c) f (d) g

Ans. (c)

Questions (48-55)

Directions: In the following questions some relations are written by particular indicators as shown below:

X = Greater than

□ = Not less than

÷ = Not equal to

∅ = Equal to

+ = Not greater than

Δ = Less than

Find out the correct answer for each question.

48. **If x Δ y ÷ z it is not possible**

(a) x ÷ ∅ z (b) x + y × z (c) x ÷ y × z (d) x Δ y □

Ans. **(a)**

49. **If x □ y □ z it is not possible**

(a) x ∅ y ÷ z (b) x ÷ y + z (c) x + y □ z (d) x + y Δ z

Ans. **(d)**

50. **If x ∅ y x z, it is possible**

(a) x × y Δ z (b) x ∅ y + z (c) x ∅ y □ z (d) x Δ y ÷ z

Ans. **(c)**

51. **If x ÷ y Δ z, it is not possible**

(a) x × y + z (b) x ÷ y × z (c) x □ y ÷ z (d) x + y + z

Ans. **(b)**

52. **Shahbaz is elder 3 days 10 hours from Nawaz. The date of Birth of Nawaz is 21 Nov. at 7 A.M. then what will be the date of birth of Shahbaz?**

(a) 16 November (b) 17 November (c) 18 November (d) 19 November

Ans. **(c)**

53. **First day of the month is Wednesday and Last day of the same month is Tuesday, then which one will be that month?**

(a) January (b) February (c) March (d) August

Ans. **(b)**

54. **Write in a correct sequence**

(a) Rainbow (b) Rain (c) Sun (d) Happiness (e) Children

(1) dbcea (b) deabe (c) badce (d) bcaed

Ans. **(d)**

55. **In the group of 26 girls Saima's Position is 7 from the bottom. What is the position of 'Saima' from the top of the group?**

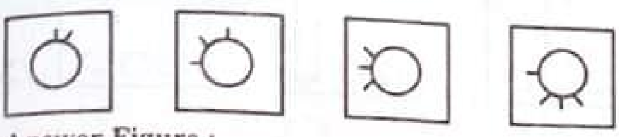
(a) 20th (b) 21st (c) 22nd (d) 17th

Ans. **(a)**

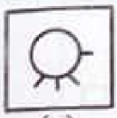
Questions (56-60)

Direction: Two sets of the figures are given. One set of Question-figures and another set is of Answer-figures. Question-figures are arranged in sequence. One figure from the Answer figures is to be selected such that it can be placed after the series of Question-Figures. Find the correct Serial number of the selected Answer-Figure.

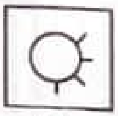
56. **Question-Figure**



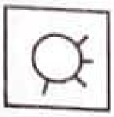
Answer Figure :



(a)



(b)



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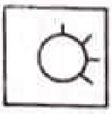
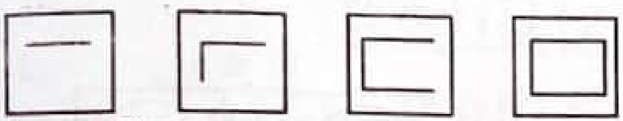


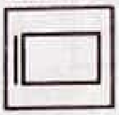
(d)

Ans. **(a)**

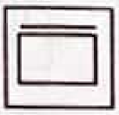
57. **Question Figure**



Answer Figure :



(a)



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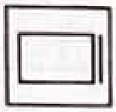

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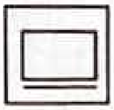
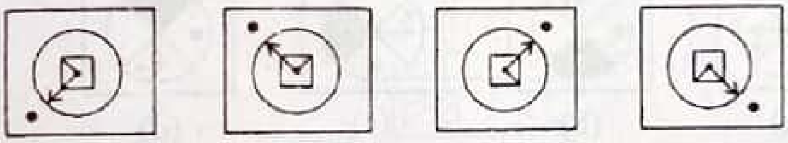


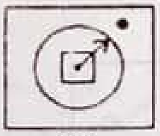
(d)

Ans. **(b)**

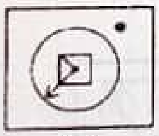
58. **Question Figure**



Answer-Figures



(a)



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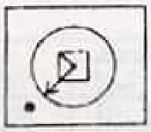

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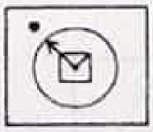
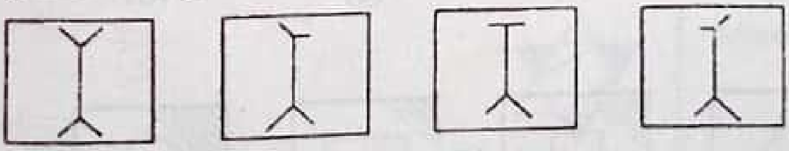


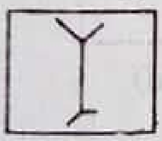
(d)

Ans.

59. **Question Figure**



Answer-Figures



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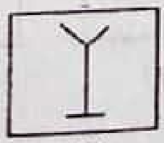

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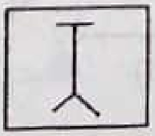

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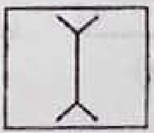
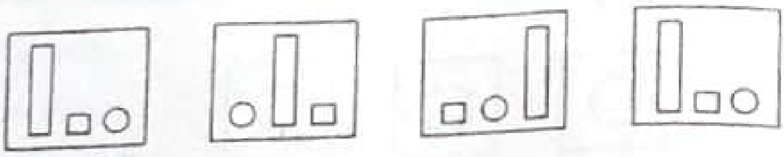


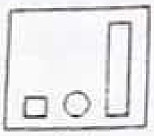
(d)

Ans.

60. **Question Figure**



Answer-Figures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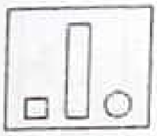
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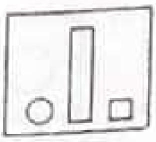
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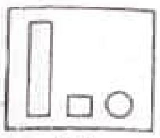
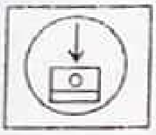

(d)

Direction (61-65): In each of the following questions four figures are given. One of these figures does not fit with the rest of the figures. Find out that correct serial number.

Ans. (c)

61. **Question Figure**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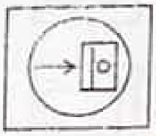
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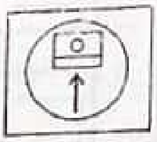
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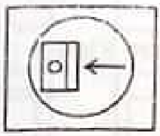
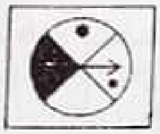

(d)

Ans. (a)

62. **Question Figure**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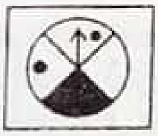
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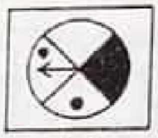
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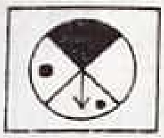
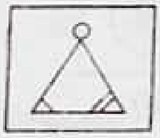
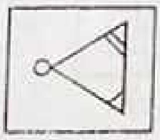

(d)

Ans. (d)

63. **Question Figure**


(a)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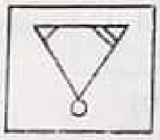
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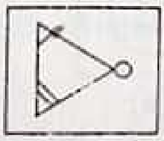
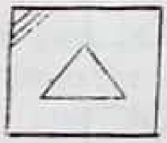

(d)

Ans. (c)

64. **Question Figure**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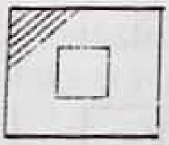
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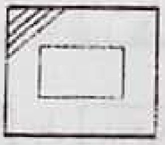
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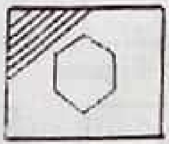
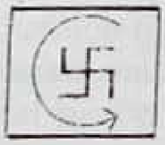

(d)

Ans. (b)

65. **Question Figure**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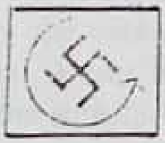
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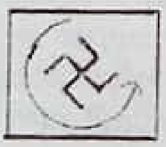
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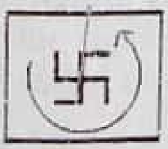
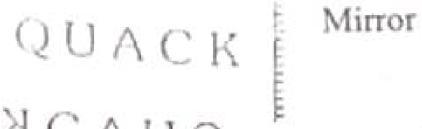
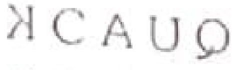
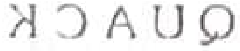

(d)

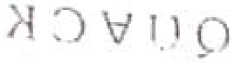
Ans. (c)

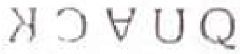
66. **Question Figure**



(a) 

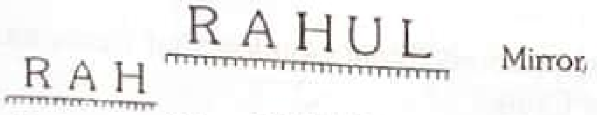
(b) 

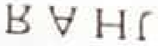
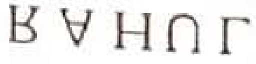
(c) 

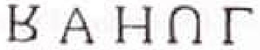
(d) 

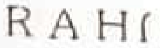
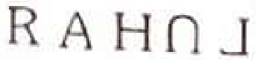
Ans. **(b)**

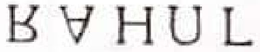
67.



(a) 
(a) 

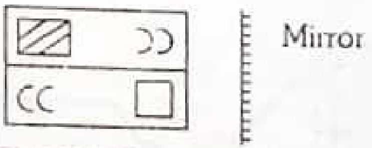
(b) 

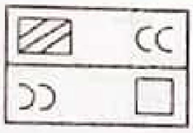
(c) 
(c) 

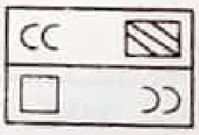
(d) 

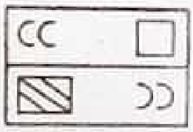
Ans. **(b)**

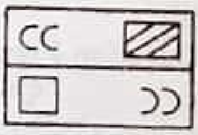
68. **Question Figure**



(a) 

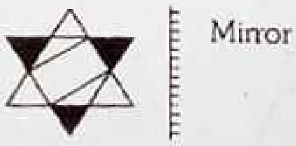
(b) 

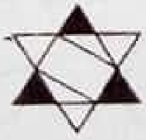
(c) 

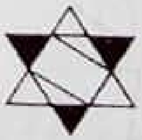
(d) 

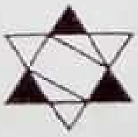
Ans. **(b)**

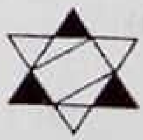
69. Question Figure



(a) 

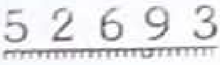
(b) 

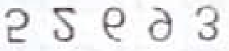
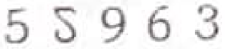
(c) 

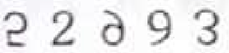
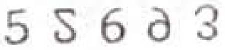
(d) 

Ans. **(b)**

70. **Question Figure**



(a)  (b) 

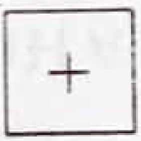
(c)  (d) 

Ans. **(a)**

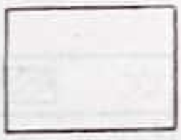
Questions (71 to 75)

Direction: In the following questions figure is given, that figure exists in one of the given alternative figure find out that figure.

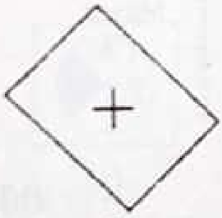
71. **Question Figure**



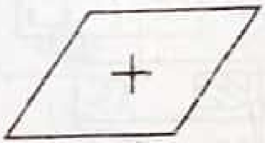
Answer-Figures



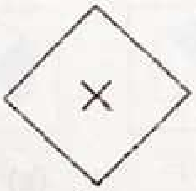
(a)



(b)



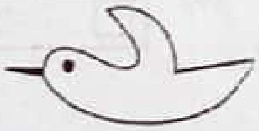
(c)



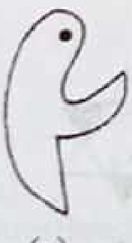
(d)

Ans. **(d)**

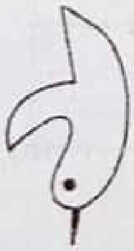
72. Question Figure



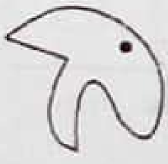
Answer-Figures



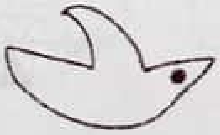
(a)



(b)



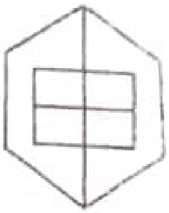
(c)



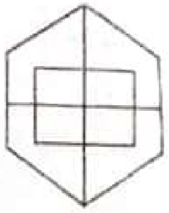
(d)

Ans. **(b)**

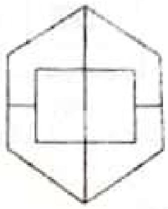
73. **Question Figure**



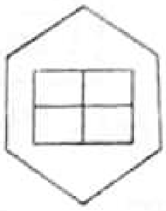
Answer-Figures



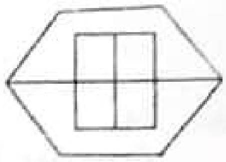
(a)



(b)



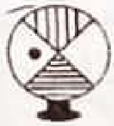
(c)



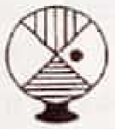
(d)

Ans. (d)

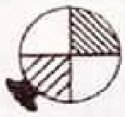
74. **Question Figures**



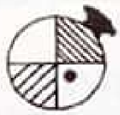
Answer-Figures



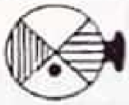
(a)



(b)



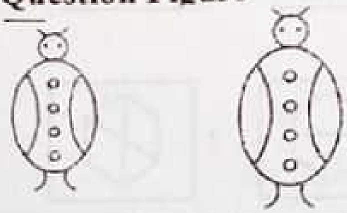
(c)



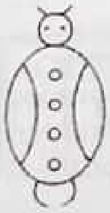
(d)

Ans. (c)

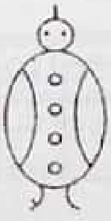
75. **Question Figure**



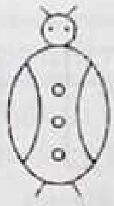
Answer-Figures



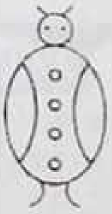
(a)



(b)



(c)



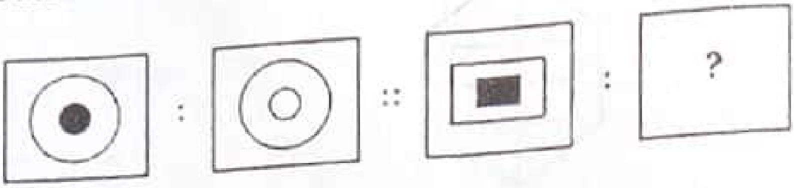
(d)

Ans. (d)

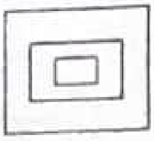
Questions (76 to 80)

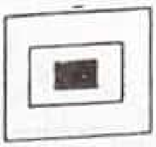
Direction: In the following questions there is some relationship between the two figures on the left of (::) the same relationship exists between the two terms on the right of which one is missing. Find the missing one from the given alternative.

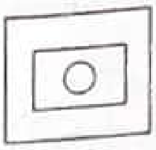
76. Question Figure

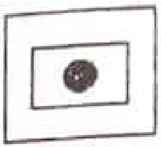


Answer-Figures


(a)

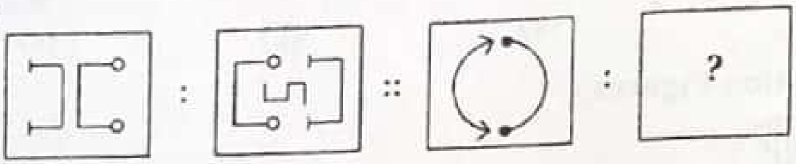

(b)


(c)

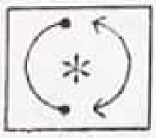

(d)

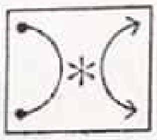
Ans. (a)

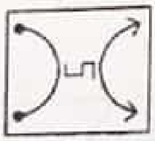
77. Question Figure

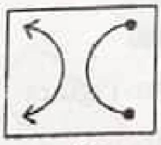


Answer figures


(a)

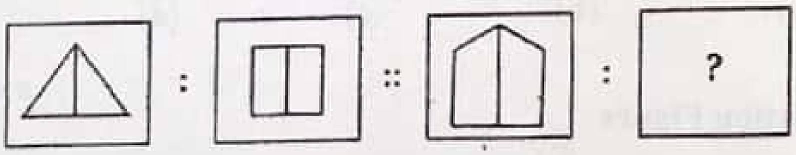

(b)


(c)

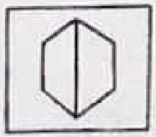

(d)

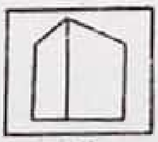
Ans. (c)

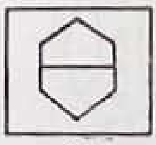
78. Question Figure

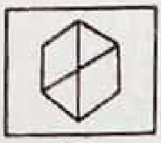


Answer-Figures


(a)

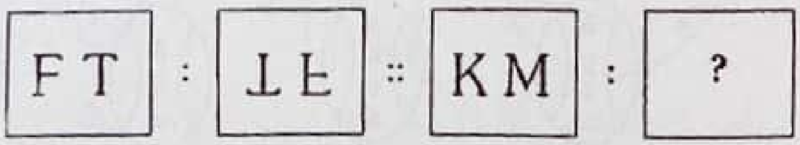

(b)


(c)

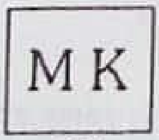

(d)

Ans. (a)

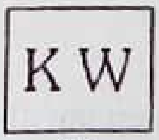
79. Question Figure



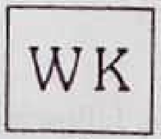
Answer-Figures



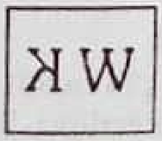
(a)



(b)



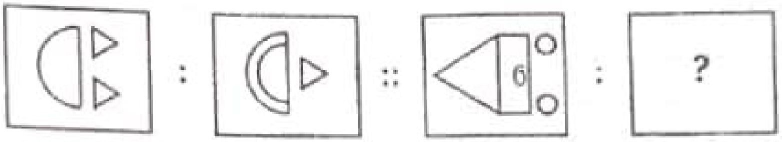
(c)



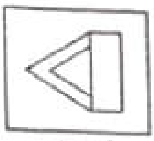
(d)

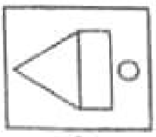
Ans. (c)

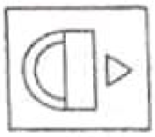
80. **Question Figure**

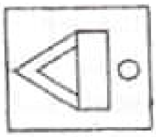


Answer-Figures


(a)


(b)


(c)


(d)

Ans. (d)

81. **In a coded language TRACE = 43251 and EARTH = 12347 then the code for FACT will be**

(a) 9245 (b) 9254 (c) 9425 (d) 9524

Ans. (b)

82. **In a coded language SHOP = 8256, WORK = 9573 and HOME = 2541 then the code for SMOKE will be**

(a) 84531 (b) 83451 (c) 84351 (d) 85431

Ans. (a)

83. **In a coded language TAKE = 1790, PLOT = 5321 then code for PLATE will be**

(a) 52701 (b) 53071 (c) 35710 (d) 53710

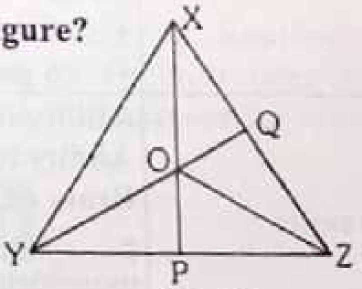
Ans. (d)

84. **In a coded language FRUIT = HTWKV then FLOWER will be written as**

(a) HNQYGT (b) HGPTYN (c) HYNGPT (d) HTPNGY

Ans. (a)

85. **What will be the number of triangles in the given figure?**



(a) 9 (b) 11 (c) 10 (d) 12

Ans. (d)

SOCIAL ABILITY (Cognitive Ability)

First of all, what is cognition? Cognition has to do with how a person understands and acts in the world. It is the set of abilities or processes that are part of nearly every human action.

Cognitive abilities are brain-based skills we need to carry out any task from the simplest to the most complex. They have more to do with the mechanisms of how we learn, remember, problem-solve, and pay attention rather than with any actual knowledge. For instance, answering the telephone involves at least: perception (hearing the ring tone), decision taking (answering or not), motor skill (lifting the receiver), language skills (talking and understanding language), social skills (interpreting tone of voice and interacting properly with another human being).

Mental functions or cognitive abilities are based on specific neuronal networks. For instance memory skills rely mainly on parts of the temporal lobes and parts of the frontal lobes (behind the forehead).

In the table below, you can browse through the main brain functions involved in cognition. You will also find **brain teasers that will help you exercise the cognitive abilities** described. Learn, and have fun!

COGNITIVE ABILITIES ARE BRAINS FUNCTIONS

Cognitive Abilities/Brains Functions	Skills involved
Perception	Recognition and interpretation of sensory stimuli (smell, touch, hearing, etc.) Brain challenges: • **Is this & circle?** • **Catch the number**
Attention	Ability to sustain concentration on a particular object, action, or thought. Ability to manage competing demands in our environment. Brain challenges: • **Count the letters** • **Spot the differences** • **Awareness test**
Memory	Short-term/ working memory (limited storage). Long-term memory (unlimited storage).Brain challenges: • **Can you do better than a chimp?** • **5 games to test your memory**
Motor skills	**Ability to mobilize our muscles and bodies.** **Ability to manipulate objects.** **Brain challenges:** • Tap your right hand on the table. At the same time, make a circular movement with your left hand (as if you were cleaning the table) • Switch hands·
Language	Skills allowing us to translate sounds into words and generate verbal output. Brain challenges: • **Words associations** • **What is the word?**
Visual and Spatial Processing	Ability to process incoming visual stimuli. Ability to understand spatial relationship between objects. Ability to visualize images and scenarios. Brain challenges: • **Build the box** • **Which piece is missing?**

Executive Functions	Abilities that enable goal-oriented behavior, such as the ability to plan, and execute a goal. These include: **Flexibility:** the capacity for quickly switching to the appropriate mental mode. **Theory of mind:** insight into other people's inner world, their plans, their likes and dislikes. **Anticipation:** prediction based on pattern recognition. **Problem-solving:** defining the problem in the right way to then generate solutions and pick the right one. **Decision-making:** the ability to make decisions based on problem-solving, on incomplete information and on emotions (ours and others'). **Working Memory:** the capacity to hold and manipulate information "on-line" in real time. **Emotional self-regulation:** the ability to identify and manage one's own emotions for good performance. **Sequencing:** the ability to break down complex actions into manageable units and prioritize them in the right order. **Inhibition:** the ability to withstand distraction, and internal urges. Brain challenges: • **Sunday afternoon quiz** • **Which way is the bus going?** • **Tipping the scales** • **The empty triangle The Tower of Hanoi**

COGNITIVE ABILITIES CAN IMPROVE IF EXERCISED

With age, some cognitive abilities decline, especially executive functions. In addition, cognitive abilities that are not used regularly tend to diminish over time. Fortunately, growing evidence shows that decline can be delayed with appropriate lifestyle options and practices.

MENTAL ABILITY TEST

PART- 1

Directions: In the following questions (1-10) there are five groups of letters in each. Four of these groups are alike in same way while one is different. Find the one that is different and will be your answer as well.

Q.1. (a) asibu (b) oarse (c) oinak (d) zamol (e) yaixe

Ans. (d) as each contains 2 consonants and 3 vowel but d does not.

Q2. (a) MNM (b) HJR (c) VWD (d) BCX (e) KLO

Ans. (b) as in others first two letters are serially pronounced but (b) is not in order.

Q3. (a) ira (b) aam (c) kas (d) utr (e) btd

Ans. (e) as all other four gives a sense of words by arranging the letters as air, man ask and true but (e) does not as such.

Q4. (a) yxz (b) cbd (c) nmr (d) wvx (e) pqo

Ans. (e) as in other four we find the middle letter in the initial letter in order like xyz, bcd, etc.

Q5. (a) AiiR (b) MooX (c) VxxZ (d) DecY (e) DffH

Ans. (d) as other four there are some letters repeated twice in the middle which is a deviation in (d).

Q6. (a) cot (b) pot (c) but (d) hut (e) mat

Ans. (e) pronunciation changed.

Q7. (a) AabD (b) eEcf (c) pPrs (d) nNxz (e) dDrs

Ans. (a) as the first letter is capital.

Q8. (a) ability (b) capability (c) probability (d) surety (e) flexibility

Ans. (d) as in others 'li' is absent to give a right sense but (d) has already a sense.

Q9. (a) doe (b) man (c) xaz (d) poq (e) oep

Ans. (c) as in all others two consecutive alphabets occur at the ends as de, mn, pq, and op.

Q10. (a) ACE (b) PKR (c) NPR (d) GIK (e) PRT

Ans. (b) as in all others in each alphabet there is a difference of one space.

Directions: In each of following questions, there are four or five alternatives given. Find the correct one for each question.

Q11. **Two numbers are in the ratio 5:6 and if 4 is subtracted from each, they are reduced to 2:3, then the highest number is**

(a) 4 (b) 12 (c) 8 (d) 10

Ans. (c) the highest number be 6x and the least number be 5x.

Sol: As the problem $\frac{5x-4}{6x-4} = 2:3$

$15x - 12 = 12x - 8$ or $15x - 12x = -8 + 12$

or $3x = 4$ or $x = 4/3$

So largest number is $6x = 6 \times 4/3 = 8$

Q12. **A square and a triangle have equal areas. If the ratio side of square and the height of triangle is 2/3 find the ratio of base to height.**

(a) 2/3 (b) 4/3 (c) 4/5 (d) 9/8

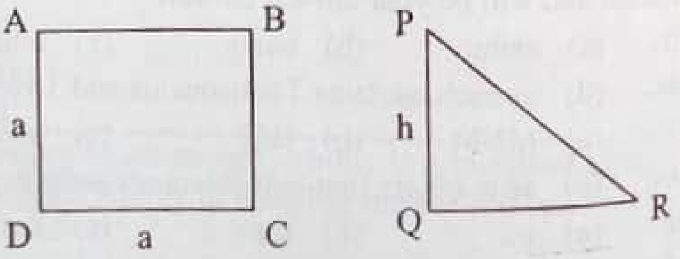
(e) None of these

Ans. As the problem

$a^2 = 1/2h \times b$

$\frac{a}{h} = 2/3$ or $d = 2/3h$

$h = 3/2b$



From equation (i)

$\frac{1}{2} h b = a^2$

$\frac{1}{2}$ h b = $(2/3h)^2$ = $4/9h^2$ or *h/b* = 1/2/4/9 = $\frac{1}{2}$ × 9/4 = 9/8

Q13. How many prime numbers lie between 115 – 122.

(a) 2 (b) 3 (c) 4 (d) 5 (e) 6

Ans. 115, 116, 117, 118, 119, 120, 121, 122.

Q14. Rahat is 5 times as old as Waqar. If their difference of age is 8 years, how old is Rahat?

(a) 8 years (b) 10 years (c) 12 years (d) 5 years
(e) None of these

Ans. **(b) 10 years**

Sol. Suppose Waqar age = x

So Rahat's age = 5x

As per the problem

5x – x = 8 or 4x = 8 or x = 2

So Rahat's age = 5x = 5 × 2 = 10 years

Q15. A runs faster than E but not so fast as B and B runs faster than C but not as faster than D, who runs faster?

(a) A (b) B (c) C (d) E

Ans. (d)

Q16. The pages of a book are numbered from 1 to 100 manually. How many times will be it be essential to write the number 5?

(a) 20 (b) 19 (c) 18 (d) 9 (e) 10

Ans. (b)

Q17. A person climbs up a pole of 88 mt high, in every minute he climbs 12 mt but slips down 8 mt. So how much time he will take to reach at the top?

(a) 19 (b) 29 (c) 28 (d) 22 (e) 14

Ans. It is clear that in the last step, he does not slip as he reaches on the top so actual distance which cover for slipping zone will be 88 – 12 = 76, actual distance covered in a minute is 12-8 = 4. So the time taken will be 76/4 = 19

Q18. How many square of side 5 cm cab ve adjusted in a rectangular box of size 25 × 15 × 10 cm

(a) 30 (b) 60 (c) 50 (d) 40
(e) None of these

Ans. Volume of square = 53

Volume of given rectangle = 25 × 15 × 10 cm

As per the question = $\frac{25\times15\times10}{5\times5\times5} = 30$

Q19. The sum of 3 positive numbers in AP is 189. The sum of their squares is 11915. Find their product.

(a) 7930 (b) 8970 (c) 9703 (d) 7960
(e) None of these

Ans. Let the numbers in AP series be

$a - d, a, a + d$

So $a - d + a + a + d = 189$ or $3a = 189$

or $a = 63$

As per second part of the problem

$(a - (d)^2 + (a)^2 + (a + (d)^2 = 4023$ or $3a^2 + 3d^2 = 4023$

or $3 \times (63)^2\ 2d^2 = 4023$

or $2d^2 = 11915 - 3 \times 63 \times 63$

$= 11915 - 11907$

$= 08$

or $d^2 = 4$ or $d = 2$

So their product is $(a - (d) \times a \times (a + (d)$

$= (63 - 2) \times 2 \times (63 + 2) = 61 \times 2 \times 65$

$= 130 \times 61$

$= 7930$

Q20. Find the number whose square root is twice of its cubic root.

(a) 128 (b) 64 (c) 16 (d) 4

(e) None of these

Ans. Let the number be x

As per the problem $2\sqrt{x} = 2 \times 3\sqrt{x}$

or $x^{1/2} = 2X^{1/3}$

Raising both sides by 6 times

$(x^{1/3})^6 = 2^6 (x^{1/2})^6$

$x^{1/2 \times 6} = 2^6 x^{1/3 \times 6}$

or $x^3 = 64\, x^2$ or $x = 64$

Q21. There are 24 birds on a tree. A hunter fired a gun and 20 fell down on ground. So how many birds left on the tree?

(a) 4 (b) 7 (c) 24 (d) None of these

Ans. None of these as its clear from the general ideology.

Q22. A is four times as efficient as B & A can complete a work in 90 days less time than B. Find in how many days both can complete the work.

(a) 30 (b) 20 (c) 40 (d) 50

Ans. Let the given work be done by B in x days

As per the problem $x - 90 = \frac{x}{4}$ or $4x - x = 90$ or $x = 30$ days.

Since A is 3 times as efficient as B.

Q23. I am the eldest child of my parents. There is a gap of 6 years between the ages of my brother and sister including myself. If my mother was 22 years, when I was born? What was age at the birth of her youngest child?

(a) 30 (b) 28 (c) 16 (d) 25

None of these.

Ans. (c)

Q24. The calendar of the year 1982 can next be used for the year?

(a) 1984 (b) 1990 (c) 1985 (d) 1988

(e) None of these

Ans. (d) 1988

Q25. Two successive discount of 20% and 25% equivalent to what amount of a single discount?

(a) 25% (b) 10% (c) 15% (d) 5% (e) 20%

Ans. Let the amount be = Rs. 100

After 20% of discount, actual amount payable

$$= 100 - \frac{20}{100} \times 100 = 80$$

In second case the discount is 25%

So the total single discount will be = $\frac{25}{100} \times 80 = 20\%$

Q26. If x persons can complete work in t hours, in how many hours y persons can complete it?

(a) $\frac{yt}{x}$ (b) $\frac{yx}{t}$ (c) $\frac{tr}{y}$ (d) $\frac{tx}{y}$

(e) None of these

Ans. x person can complete in t hours

1 person can complete in t × x hrs

y person can complete in = $\frac{t \times x}{y} = \frac{tx}{y}$

Q27. Majid spent 25% of his monthly earning on magazines. Out of the banana amount he spent 75% on the hostel and college fees. If he had Rs. 120 at the end of the month, find how much money he has received from his father in that month?

(a) Rs. 1000 (b) Rs. 1260 (c) Rs. 640 (d) Rs. 850

(e) None of these

Ans. Let the monthly income be = x

Expenditure on magazine = 25 × = $\frac{1}{4}x$

So balance amount = $x - x/4 = \frac{3}{4}x$

And hostel and college expense = $3/4x \times 75/100 = 9x/16$

So balance amount he had = $\frac{3}{4}x - 9x/16$

$$= \frac{12x - 9x}{16} = \frac{3x}{16}$$

As per the problem = $\frac{3x}{16} = 240$

Or $3x = 120 \times 16$ or $x = \dfrac{120 \times 16}{3} = \text{Rs. } 640$

Q28. A, B and C are partners and invests in a business such that A spends 1/4th of the total. B spends 1/5 less than C. If C's investment is 1/3, find the ratio of their profits on a amount of 4300.

(a) 15:20:8 (b) 20:15:8 (c) 8:15:20 (d) 25:5:8

(e) None of these

Ans. Let the total capital be = x

A's share = 1/4x = x/4

C's share = 1/3 x = x/3

$$\text{B's share} = x/3 = x/5 = \frac{5x - 3x}{15} = \frac{2x}{15}$$

So their ratio of investment is

$$\frac{x}{4} : \frac{x}{3} : \frac{2x}{15} = \frac{x}{4} \times 60,\ \frac{x}{3} \times 60,\ \frac{2x}{15} \times 60$$

15x : 20x : 8x

Profit will be distributed as per proportion of their investment.

So $15x + 20x + 8x = 4300$

Or $43x = 4300$ Or $x = \dfrac{4300}{43} = 100$

A's profit = 1500

B's profit = 2000

C's profit = 800

A : B : C = 1500 : 2000 : 800 = 150 : 20 : 8

Q29. In a cage, there are rabbits and parrots and the number of heads are 28 and feet are 72. Find the number of parrots and rabbits.

(a) 20, 8 (b) 8, 20 (c) 14, 14 (d) 12, 16

(e) None of these

Ans. Let there be x parrots and y rabbits

As per the problem,

Total number of heads = 28 = x + y (i)

Total number of legs = 72 = 2x + 4 y

= x + 2y = 36 (ii)

Solving equation (i) and equation (ii)

x + y = 28

x + 2y = 36

y = 8

and x + y = 28 or x = 28 − 8 = 20

So there are 20 parrots and 8 rabbits.

Q30. **Some students are divided into two groups A & B. If 10 students are sent from A to B, the number in each is the same. But if 20 students are sent from B to A, the number in A is double the number in B. Find the number of students in each group A & B.**

(a) 100,80 (b) 80, 100 (c) 110,70 (d) 70, 110
(e) None of these

Ans. Let the number in A and B be a & b respectively

As per the question $a - 10 = b + 10$

$a - 2b = 20$

and $a + 20 = 2(b - 20)$

$a - 2b = -20$ (ii)

Solving $A = 100$; $B = 80$

Directions: In each of the following questions, a series of numbers is given followed by a blank space with a (?) question mark on it. The number to fill in the blank is given has one of the alternative among the five given under each question. Find the correct alternative in each case.

Q31. **3,18,43, 78,123,?**

(a) 169 (b) 178 (c) 163 (d) 153 (e) 157

Ans. The Arithmetic mean difference between the two consecutive numbers is increasing 10 as 15 25 35 45. So the numbers will be 123 + 55 = 178

Q32. **1,5,13,29,61,125,?**

(a) 252 (b) 258 (c) 255 (d) 253
(e) None of these

Ans. The mean difference between the consecutive numbers are

1 5 13 29 61 125 ?
4 8 16 32 64 128

So 125 + 128 = 253

Q33. **49, 343, 64, ?, 81, 729**

(a) 1024 (b) 512 (c) 778 (d) 182
(e) None of these

Ans. The first and second terms are square cube of 7, 5th and 6th terms are square and cube of 9. So third and fourth terms are square and cubes of 8. $8^3 = 512$

Q34. **55296, ?, 288, 36, 9.**

(a) 3456 (b) 3436 (c) 4638 (d) 3638
(e) None of these.

Ans. $\frac{9}{36}$ $\frac{36}{288}$ $\frac{288}{x}$ $\frac{x}{55296}$

$\frac{1}{4}$ $\frac{1}{8}$ $\frac{1}{12}$ $\frac{1}{16}$ like this.

So $\frac{288}{x} = \frac{1}{12}$ or $x = 3456$

Q35. **30, 56, 90, 132, 182, ?**

(a) 3627 (b) 3234 (c) 1206 (d) 2412

(e) None of these.

Ans. (a)

Directions: The six faces of a cube are painted in a manner that no two adjacent faces have the same colour. The three colours used in the painting are red, blue and green. The cube is then cut into 64 equal cubical parts. Answer the following questions

Q36. **How many cubes in all have three sides painted?**

(a) 24 (b) 16 (c) 10 (d) 8

(e) None of these

Ans. (d)

Q37. **How many cubes have only two sides painted?**

(a) 16 (b) 24 (c) 8 (d) 6

(e) None of these.

Ans. (b)

Q38. **How many cubes have one and two sides painted but the third side is not painted?**

(a) 28 (b) 24 (c) 48 (d) 64

(e) None of these

Ans. (c)

Q39. **How many cubes are there whose only one side is painted?**

(a) 24 (b) 4 (c) 48 (d) 64

(e) None of these

Ans. (a)

Q40. **How many cubes are there which has no sides painted?**

(a) 8 (b) 64 (c) 36 (d) 48 (e) 16

Ans. (a)

Directions: The following questions are based on letter series from which some of the letters are missing. The missing letters are given in the proper sequence as are of the alternative among the five given under each question. Find the correct alternative for each case.

Q41. **aab – aaa – bba –**

(a) bab (b) abb (c) baa (d) bba

(e) None of these

Ans. (c)

SOLVED PAST QUESTION PAPERS

(1993 – 2014)

EVERYDAY SCIENCE 1993

Note: Answer any ten questions. All question carry equal marks. Draw diagram where necessary.

Q.1. **Which of the following statements are true and which are false.**

(i)	Urea is a phosphorus fertilizer.	*(False)*
(ii)	Ibn Baitar was renowned Muslim Botanist.	*(True)*
(iii)	Penicillin was discovered by Edward Jenner.	*(False)*
(iv)	Ameoba is a unicellular animal.	*(True)*
(v)	Solar eclipse over on full moon.	*(False)*
(vi)	Water is a bad conductor of electricity.	*(True)*
(vii)	Leprosy is a disorder of the Nervous system.	*(False)*
(viii)	Chloroflouro carbons cause decomposition of Ozone layer.	*(True)*

2. **Solar System**

Ans. Solar system is the tiny part of galaxy and consists of the sun, objects that travel around it i.e.; Earth and eight other planets along with satellites that travel around — It further includes Asteroids, Meteoroids, comets, interplanetary dust and Interplanetary plasma.

The Sun

Sun is the central part of the solar system. It is a very big — almost a million miles across and hot.

Composition of Sun

— Hydrogen	90%
— Helium	8%
— Many elements	2%

Temperature of Sun

— Chromosphere (Inner core)	15 million °C
— Photosphere (Outer light emitting core)	6000°C

Features of Sun

(1) The sun is about 46 billion years old containing matter in the plasma state.

(2) Most of mass (99.86%) of the solar system is concentrated in sun thus holding other objects together due to high gravitational force.

(3) Source of energy in sun is due to Nuclear Fusion i.e. conversion of hydrogen into helium.

(4) Every square km. of Sun's surface emits 64 million watts into space.

(5) It has 27 day solar rotation period & 11 year sunspot cycle.

(6) Solar winds, solar flares and sunspots are its important events.

(7) Its mass is 2×10^{30} tons while average density is 1.4 gm/cc.

(8) Its distance from earth is 149 million km.

(9) Its diameter is 14 million km.

The Earth

It is most wonderful planet of the solar system. It is *water-drenched* planet.

Features of Earth

(1) It is also 4.6 billion years old but life started here about 3-4 billion years ago.

(2) Its rotation period is 23 hours, 56 minutes and 4 seconds and revolution period 365-1/4 days.

(3) The mass of Earth is 6 × 10^{21} tons and average Density is 5.52 gm/cc.

(4) Its equatorial diameter is 12,756 km.

(5) The earth has iron core, the rocky mantle and dynamic crust. It is made up of Tectonic Plates.

(6) It has an atmosphere; 78% of Nitrogen and 21% oxygen.

(7) The atmosphere has about 3100 cubic miles of water in the form of clouds which is responsible for producing seasons.

(8) Latitudes and longitudes coordinates are drawn on the map to locate position on Earth surface.

(9) The surface is rich in silicone, aluminium, iron, calcium, sodium and oxygen element.

Satellite of Earth

Earth has only one natural satellite called Moon at a distance of 3,85,000 km from Earth surface.

Features of Moon

It is 81 times lighter than earth.

It is a poor reflector 7% as compared to Earth.

It has 1/6th gravitational pull as compared to Earth.

It is rich in Chromium, Titanium, scandium, Zirconium and Yetterbium.

It's average density is 3.34 gm/c.c.

The Planets

There are nine planets including earth. The salient features of others are as follows.

1. **Mercury**

(1) It is the second smallest planet.

(2) It is closest to the sun and its mean distance is 0.387 astronomical units.

(3) Its equatorial diameter is 4,880 km.

(4) Mercury looks a lot like Moon with holes called cratens.

(5) It has no moon.

2. **Venus**

(1) It is called Earth's twin in size.

(2) It is 0.723 A.U. away from Sun.

(3) Its equatorial diameter is 12,104 km.

(4) It is wrapped in thick clouds of carbon dioxide.

(5) It has no moon.

3. **Mars**
   (1) It has hot and opaque atmosphere.
   (2) It is a barren desert covered with red dust so is -called Red Planet.
   (3) It is 1.524 A.U. away from Sun.
   (4) Its equatorial diameter is 6,787 k.m.
   (5) It has two Moons; (a) Rhobos; (b) Deimos

4. **Jupiter**
   (1) It has dense cloudy atmosphere of $H_2 + He$.
   (2) Its diameter is 1,43,000 km being largest.
   (3) It has sixteen moons.
   (4) It visits Sun once after every 11.86 years.

6. **Saturn**
   (1) It is the second largest planet.
   (2) It is 9.539 A.U. away from Sun.
   (3) Its diameter is 1,20,000 km.
   (4) It has at least 22 moons.
   (5) Its special feature is superb rings.

7. **Uranus**
   (1) It has hydrogen & helium.
   (2) It is 19.18 A.U. away from Sun.
   (3) Its diameter is 51,800 km.
   (4) It has fifteen moons.
   (5) Uranus is big and gives green glow.

8. **Neptune**
   (1) It is 30.06 A.U. away from Sun.
   (2) Its diameter is 49,500 km.
   (3) It has only two moons.

9. **Pluto**
   (1) It is the most distant and smallest planet with very low temp.
   (2) Its diameter is 4,00 km.
   (3) It has only one moon.

OTHER OBJECTS

Other objects in solar system are

1. **Asteroids**
   These are small rocky objects called minor planets floating round the sun in space.

2. **Meteorites**
   It is a chunk of material floating in space that can enter earth's atmosphere.

3. **Comets**
   It is a body of ice and dust that move around the Sun.

3. THE GREEN HOUSE EFFECT

Ans. (See Ch. 2, Green House effect)

GREEN HOUSE GASES

The gases which contribute more towards the Green House effect are called greenhouse gases.

These are:

Carbon dioxide	CO_2	Methane	CH_4
Nitrous Oxide	NO	Chlorofloro carbons	CFC

EFFECTS OF GREENHOUSE GASES ACCUMULATION

Global Warming

(1) Green house gases are building up in the atmosphere in such a way so as to trap the heat, energy, gradually raising the average temperature of the planet. It can raise average world temperature from 1.5 to 4.5 degree Celsius than today. This is called Global warming.

(2) That would induce the *melting of polar ice cops* and increase in world's sea *level* from ten inches to *six feet*.

(3) Fertile regions would be converted into deserts and Arctic plains could become suddenly arable.

(4) Destructive droughts such as that of 1988 in North America, would strike more often until the great plains would become semi deserts.

(5) Storms such as hurricanes and tornadoes might become more violent,

(6) Forests would decline and change under the temperature rise, and wild life would have to migrate if it could or perish.

Q. 2. Describe any Five-of the following in not more than four lines.

(i) Mitosis

(1) It is a type of cell division in which chromosome number remain the same.

(2) One cell gets divided into two cells.

(3) All the somatic cells such as skin cells, bone cells, muscle cells etc. divide by mitosis.

(4) It provides a means of transmitting hereditary information unchanged to daughter cells.

(ii) Hemophilia

(1) It is a disease in which the person has prolonged blood clothing time resulting in excessive breeding from injury.

(2) It is due to deficiency of vitamin 'K'.

(3) It is a semi lethal disease controlled by recessive gene.

(4) Haemophilia is less common in women than in men.

(iii) Reflex Action

(1) Reflex actions are the responses to environmental changes both internal and external and are immediate or automatic and are without intervention of will. These reflexes may be simple or conditioned e.g. watering of mouth on seeing or smelling of food.

(2) Simple reflexes are inborn, inherited or unlearnt responses to stimuli.

(3) The structural and functional basis of simple reflex is called reflex arc.

(4) Impulses are carried from receptors to sensory -neurons to CNS from where they are passed on via motor neurons to the effectors for necessary response.

(iv) **METABOLISM**

(1) Metabolism is a term that embraces all of the chemical changes that occur in the cells of living organisms enabling them to grow, to maintain their identity and reproduce.

(2) Each chemical change in metabolism is catalyzed by specific protein called enzyme.

(3) Metabolic reactions convert food into forms that can be stored until needed.

(4) These reactions provide energy for mechanical work of muscles and chemical work to build complicate molecules like DNA, UNA and protein

(v) **FISSION (See Ch. 1, Nuclear Fission)**

(vi) **NON-RENEWABLE RESOURCE**

Ans. **(See Ch. 2)**

Q.3. **Fill in the gaps with correct choice. In Five statements only.**

(1) Quartz is chemically a **silicate** (Carbonate, **silicate**, Aluminate)

(2) **Chicken egg is composed of one million cells (one cell, 1000 cells, one million cells)**

(3) Visible light energy has the wave length of **400 -700 nm.** (100-300 nm, 400-700 nm, 800-1000 nm)

(4) The particle with positive charge but mass equal to electron is called **positron**. (Neutron, Proton, Positron)

(5) Gas in children's balloon going upwards is **Hydrogen**. (Hydrogen, Nitrogen, Oxygen)

(6) Standard pressure is **760 mm.** (760 mm, 766 mm, 870 mm)

(7) Iron corrodes due to formation of **Iron oxide.** (Iron Sulphide, Iron Oxide, Iron)

Q.4. **What is the difference between a Dam and a Barrage?**

Ans. **Dam Vs Barrages**

It doesn't hold water for longer time so it is not built at great heights.

DAM	BARRAGE
It is built at greater heights where water is stored in a lake when it is allowed to roll down.	It doesn't hold water for longer time so it is not built at great heights.
It has enough it is like a distributory energy to move blades of turbine to produce electricity	It is like a distributory for water channel. It can be used for irrigation only.

Q.4b. **Why can't Barrages be used for production of hydroelectric power?**

Barrages could not be built at great heights so lack power to move turbines to produce electricity. They serve just as distributory for channels and cannot be used for hydroelectric power.

Q.5. **What are Plastics? Discuss their important properties which have contributed to their extensive use in modern industry. Explain the advance effects on Environment.**

Ans. **(See Ch. 1, Portion of Plastics)**

IMPORTANT PROPERTIES OF PLASTICS CONTRIBUTING TO THEIR EXTENSIVE USE

(1) Plastics are light in weight.
(2) These are good electrical insulators.
(3) These are chemically resistant.
(4) Plastics are usually hygienic and non-allergic,
(5) These are fungus and water resistant compounds.
(6) They could be coloured, non-coloured or transparent.

Limitations

Plastics have two major limitations.

(1) They are non-resistant to heat.
(2) They are non-resistant to sunlight.

ADVERSE EFFECTS OF PLASTIC ON ENVIRONMENT

Plastics being non-perishable remain in their same position as are formed thus polluting the environment.

Q. 6. Give reasons for any four of the following.

(i) A 25 watts incandescent bulb provides much less light than 20 watts florescent tube-light because florescent tube light produces gas which act as carrier and disperse light in a better way.

(ii) Transmission lines carry very high voltage.
Voltage acts as pressure; waves move faster carrying current away.

(iii) Wire in an electric bulb emits light when current passes through it because filament of tungsten which has high resistance emits photons.

(iv) Meat takes longer time to cook on mountain top than at sea level. At high attitudes pressure is decreased and hence boiling point of water also decreases.

(v) More stirring is needed when sugar is dissolved in cold coffee than in hot coffee.

In hot coffee, molecules of water have greater energy and they move far rapidly than of cold one. That's why, it needs less stirring.

Q. 7. Explain in detail what is balanced diet.

Ans. Balanced Diet

(See Ch. 4, portion of Balance Diet)

DIETARY DISORDERS

1. Starvation

In many parts of the world, people are unable to get enough food. As a result they remain undernourished. They become weak and lose resistance against diseases.

2. Malnutrition

If the quality of food in terms of its variety is not carefully controlled, it leads to malnutrition that is *"Improper nutrition.* Most' people in South East Asia & Africa depend on carbohydrate food which provides sufficient energy in calories but lacks other essential nutrients thus suffering from malnutrition.

3. **Food Additives:**

Some substances are added to food by food industries e.g. food colourings, preservatives and flavouring agents called food additives. They must be tested for safety because some of them are quite harmful.

Differentiate Between

	(i) LATITUDE	**LONGITUDE**
1.	Latitude is a measure-ment on map of location *North or South* of equator.	It is a measurement of location *East* or *West.*
2.	From the equator to either pole there is about 1/4 circumference of the earth thus greatest latitudes are 90° North and 90° South.	It is measured 181) East and 180° West of prime meridian making angle of full 360° of Earth.
	(ii) PIG IRON	**CAST IRON**
1.	"Pig" is a bar of cooled metal. It is the Basic raw material for steel & Cast iron.	It is generic group of metals that basically are alloys of Carbons, silicone and iron. It has
2.	It contains Silicone 1% Sulpher 0.03% Phosphors 0.27% Magnesium *2.4%* Carbon 4.6%	It has Silicone 1.5% Sulphur 1.5% Phosphors 1.5% Magnesium 1.5% Carbon 2-3% Iron rest %age
	(v) HARD WATER	**HEAVY WATER**
	The water which doesn't form lather with soap is called Hard H_2O	It is composed of an isotope of hydrogen and oxygen.
2.	It produces salts with soap, affecting its cleaning action.	It is one of the moderators used in nuclear reactors.
	(vi) CHROMOSOME	**GENE**
	These are thread like structures present in the nucleus.	These are unit of Inheritance lying on chromosomes at specific sites called Locus.
2.	Chromosome number is constant in different organisms.	Genes of different traits on chromosome may be hundreds of thousands.

Q.8. What are warm blooded animals? Give any two examples. Explain three traits in warm blended animals.

Ans. Warm Blooded Animals

"Animals, whose body temperature remains constant with respect to surrounding environment, are called warm blooded animals."

Examples: 1. Man 2. Whale

Traits in Warm Blooded Animals

Q.9. What does the abbreviation LASER stands you? Point out three differences of laser & ordinary light mention two applications of laser.

Ans. Derivation of Word Laser

The mechanism of laser relies on a process known as stimulated emission and the word LASER is derived from Light Amplification by Stimulated Emission.

Difference b/w Laser & Ordinary Light

	LASER	ORDINARY LIGHT
1.	Laser can produce light of single frequency.	It is made up of seven colours with different frequencies & wavelengths.
2.	Laser light has high penetrating power.	Ordinary light has less penetrating power.
3.	Laser lies in the invisible spectrum.	Ordinary light lies in visible spectrum.
4.	Laser is an intense beam that is produced due to emission of electrons.	Ordinary light is a natural phenomena produced chemically.

Q.10. Name the instruments used for measuring.

	QUANTITY	INSTRUMENT
(i)	Pressure.	Manometer
(ii)	Voltage	Voltmeter
(iii)	Purity of milk	Lactometer
(iv)	Temperature	Thermometer
(v)	Velocity of wind.	

Q.11. What are Computers? Name their Different classes. Briefly explain Soft Ware & Hard Ware Computer.

Ans. (See Ch. 5, portion of Computers)

Q.12. Name five scientists well-known for their contribution in following fields.

	QUANTITY	SCIENTIST
(i)	Chemistry	Jabir Ibn Hayyen
(ii)	Algebra	
(iii)	Light	Al Beruni
(iv)	Sound	
(v)	Eye-Surgery	Ibn Al-Haisham

Q.13. Fill in the blanks.

(i) Starch is a polymer of ___________.

(ii) A big astronomical observatory known as was established during the reign of ___________

(iii) Adrenalin is secreted by ___________

(iv) ___________ is planet nearest to earth.

(v) Moulds belong to group of plants called ___________

(vi) CFC is abbreviation of ___________

(vii) A Junction-diode is formed by ___________ pieces.

ANSWERS

(i)	Carbohydrates.	(ii)	Caliph Mamoon.
(iii)	Adrenal Cortex,	(iv)	Mars
(v)	Fungi.	(vi)	Chloro Flouro Carbon.
(vii)	Semiconductor		

EVERYDAY SCIENCE 1994

Q.1. Which of the following statements are true and which are false?

Ans. *(a)* Bacteria are parasites. (False)

(b) Ruby is an oxide of Aluminium. (True)

(c) In the Australian continent, days are longer than nights in June. (False)

(d) Gypsum is hydrated $CaCo_3$ chemically. (False)

(e) There are 23 moons around Saturn. (False)

(f) Pluto is the farthest planet from sun. (True)

(g) Chromite contains chromium oxide. (False)

(h) Mica is a non-conductor of electricity. (True)

(i) Sun is the biggest star in the universe. (False)

(j) The earth completes one rotation about its axis in 365.25 days. (False)

Q. 2. Write short notes on any 2 of the following:

(a) **Structure of animal cell:**

Definition: Cell is a structural and functional unit of all living organism. "It is a fundamental living unit".

The Basis of Cell Theory: It states that both plants and animals are made up of cells.

Cell is infact an elaborate system of molecular machinery. It is so small that it can be seen only under microscope.

(For details, see Ch. 1, Portion of Cell)

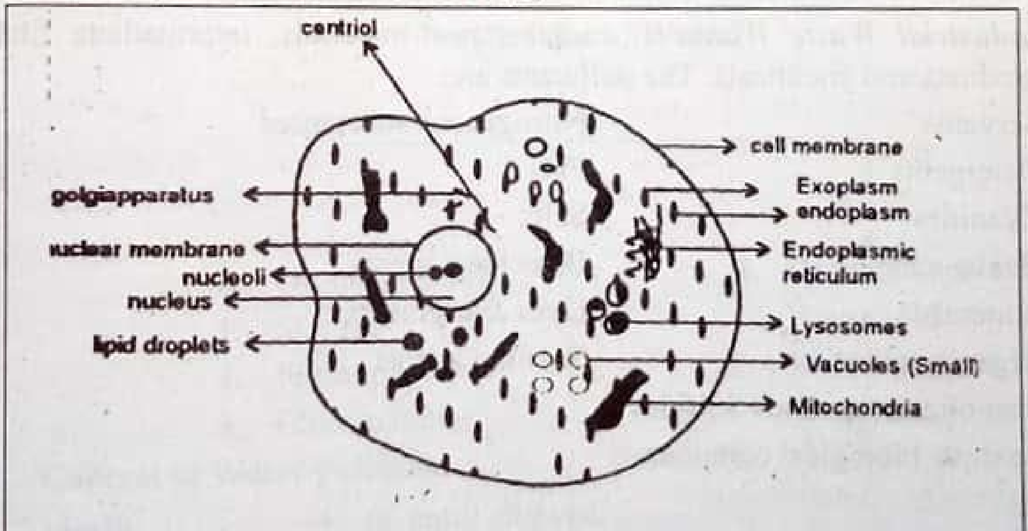


Fig. Animal Cell

ANIMAL CELL

(b) **WATER POLLUTION**: "It is the presence of pollutants in water".

Factors which are responsible for water pollution are:

(1) Rapid population growth

(2) Discharge of biological contaminants into natural water sources.

(3) Chemical contamination from industrial waste.

(4) In rural areas, majority use untreated ground water and surface water for drinking and domestic purposes.

(5) In urban areas, urbanization, population growth and industrialization has increased the water supply demand and increased production of sewage where the sewage and water pipes are running closely, small leakages result in water contamination.

Sources of Water Pollution:

It can occur at various points in the water supply system:

(1) Catchments areas
(2) Streams
(3) Wells
(4) Springs
(5) Water treatment plants
(6) Reservoirs
(7) Distribution system
(8) Public standpoints
(9) Sewers
(10) Septic tank discharges
(11) Defective latrines
(12) Manure heaps
(13) Unsanitary disposal of excreta
(14) Improper operation of water $^{T}/_{M}$ plants by operators.
(15) Leakage in water distribution system (organic pollution)

Types of Water Pollution:

(1) Sewage Waste Water: It contains organic matter which exerts a demand on O_2 resources of the receiving water. It is called as Biological Oxygen Demand (B.O.D) The organic matter contains carbohydrates proteins, fats oils, sewage has also variety of organisms (pathogen) which are infective to man.

(2) **Storm Water Run Off:** It has also a certain B.O.D.

(3) ***Industrial Waste Water:*** It contains raw materials, intermediate final and by-products and chemicals. The pollutants are:

Servants
Detergents
Cyanides
Heavy metals
Minerals
Organic acids
Phenolic compounds Sulfides
Toxic & biological compounds

Nitrogenous substances
Fats
Salts
Bleaching agents
Dyes & pigments
Tanning agents

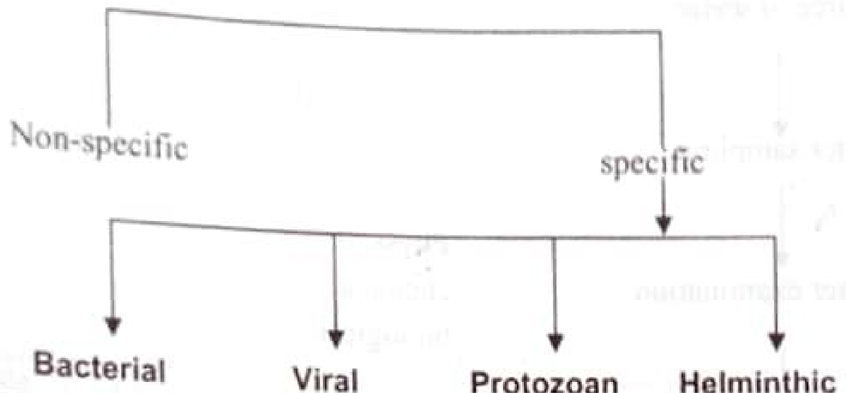
They have:

⇒ Biological Oxygen Demand (BOD)
⇒ Chemical Oxygen Demand (COD)

(4) **Agricultural Waste Water:**

— Animal wastes
— Manure
— Inorganic salts
— Sediments from land
— Pesticides
— Minerals
— Run off water from irrigated & fertilized farm lands.

Diseases Transmitted by Water



Non-Specific Diseases

1. GIT disturbances
2. Dental flourosies
3. Dental caries
4. Pb poisoning

Bacterial Diseases

1. Cholera
2. Typhoid
3. Bacillary dysentery
4. Diarrhoea

Helminthes

1. Hydrated cyst
2. Dracenclosis

Viral Disease

1. Polio
2. Trachemia
3. Infective hepatitis
5. Endeuir goiter

Protozoal

1. Amoeba Dysentery

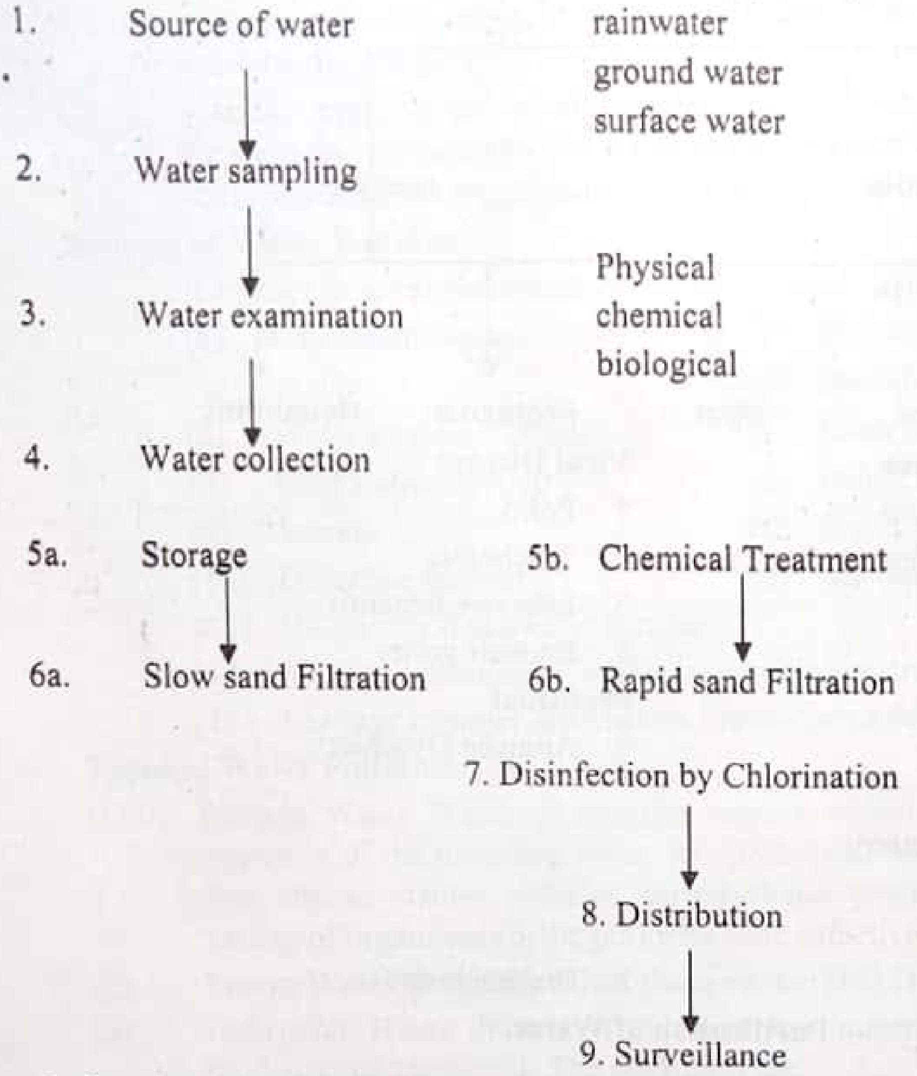
Purification of Water

A. On large Scale	B. On small scale
1. Storage	1. Household
2. Filtration	2. Well water
3. Chlorination	

Control of Water Pollution

1. Ideally → no entry allowed.
2. Possibly → keep it minimum.
3. Desirably → stream to recover.
4. Essentially → original quality to be maintained.
5 Usefully → coordinate with others
6. Legally → apply regulations.

Plan for safe water supply to public:



Q. 3. Describe briefly any five (1 mark each):

Ans. **Alloy**: When two or more suitable metals are melted together and then the molten mixture is allowed to cool down and harden it is called as an Alloy.

This is done to get desired properties from the metals. Alloys behave differently from the metals mixed. Most of the corrosion problems are slowed down by using alloys.

Examples:

(1) ***Stainless Steel:*** Is the best known example of the corrosion resistant alloy. It belongs to the family of steel-alloys of iron with other metals, here iron is alloyed to get rust resistance substance.

(2) ***Amalgam***: It contains Hg with Zn, Na, Li. It is a silvery white porous crystalline mass; it is used in dental fillings silvering of mirrors and as catalysts.

(b) ***Polymer***: "It is a long chain molecule made up of monomer units in a repetitive manner under special conditions of temperature, pressure and catalyst".

Polymerization: "It is a chemical reaction in which the small molecules called monomers unite together to form a large chain molecule, polymer".

The product of polymerization is called a "synthetic polymer"

Significance: All plastics are made up of polymers and there are about 60,000 plastics.

Length of a polymer determines the strength and durability of plastic. Chemical reaction:

$$\underset{\text{monomer}}{\underset{\text{ethylene gas}}{CH_2 = CH,}} \xrightarrow[\text{(Ni, Cd, } Al_2O_3\text{)}]{\text{• high pressure • special catalyst}} \underset{\text{ethylene, polythene)}}{\underset{\text{Polymer, Poly}}{\overset{-CH_2-CH_2-CH_2 \quad \text{OR}}{(-CH_2-CH_2-CH_2)_n}}}$$

Polymer Types:

	Natural		**Synthetics**
1.	Proteins e.g., meat, chicken, beef, fish	1.	Polyethylene
2.	Cellulose	2.	Terylene
3.	Starch Carbohvdrates		
4.	Wool	4.	Bekalite
5.	Silk	6.	Melamine
6.	Cotton		

(c) **Balanced Diet:**

"A food that contains all the nutrients in optimal quantity is called as Balanced Diet".

Food is a complex mixture of chemical substances. It performs following useful functions when eaten and absorbed by the body.

— Produce energy — Promote growth

— Repair the tissues — Regulate various processes

Nutrients:

These are the chemical components of food capable of performing above functions.

Example: Milk is a balanced died although it does not contain iron.

Various food Nutrients are

such as penicillin which microorganism are called antibiotics act on

Nutrient	Source	Function
1. Carbohydrates	Bread, Potatoes, Sugar	Provide energy
2. Fats	Butter, Cheese	Provide energy
3. Proteins	Meat, Fish, Eggs, Milk	Growth & repair
4. Minerals	Vegetables, fruits	Control body processes
5. Water	Water, fruits	Control body processes
6. Vitamins	Fruits, vegetables	Control body processes

Q. 4. Fill in the Blanks.

Ans. 1. The capacity to do work is called en ________.

2. The energy possessed by a body due to its position is called ________

3. Kitab-al-Manazar is a publication by a famous Muslim scientist about ________
4. Nucleus usually lies in the centre of an ________
5. Calcium and phosphorus are the ________ elements of bones.
6. Proteins are formed by combination of ________
7. Rain water dissolves SO_2 to form ________
8. The set of instruction given to a computer is called command.
9. Chemicals such as penicillin which act on microorganism are called ________
10. The disease Hemophilia is caused by the deficiency of ________.

ANSWERS

1.	Energy	2.	Potential energy
3.	Optical works	4.	Animal cell
5.	Essential	6.	Amino Acids.
7.	Sulfuric Acid	8.	Command
9.	Antibodies	10.	Vital

Q. 5. Which part of (1/2 each)

Ans.

(1) Ginger → Stem
(2) Reddish → Root
(3) Potato → Stem
(4) Cinnamon → Stem
(5) Peanut → Fruit
(6) Saffron → Flower
(7) Almond → Fruit
(8) Chilies → Fruit
(9) Spinach → Leaf
(10) Tomato → Fruit

Q. 6. Which field of study do the following branches of science represent? (1 each)

Ans. (1) Heamatology → Blood
(2) Cytology → Cell
(3) Morphology → Gross and microscopic structure
(4) Psychology → Psyche
(5) Geology → Earth

Q. 7. Fill in the blanks with correct choice:

Ans.

(1) In a heat engine, heat energy is changed into **mechanical energy.**
(2) Frequency of audible sound in hertz is 20 to **20,000 Hertz.**

(3) Deficiency of vitamin B causes **Beri Beri.**

(4) Cheapest source of producing electricity is **water.**

(5) The smallest unit of measurement of wavelength is **nanometer.**

(6) The chemical generally used in refrigerators **is Freon.**

(7) The unit "TON" to specify A.Cs is equal to **12,000.**

(8) The unit of electricity kwhr is the unit **of power.**

(9) Period of famous Muslim scientists is **7th to 13th** century.

(10) Heat radiation travels at speed equal to speed light.

(11) **What are viruses? Describe their structure. Which of the following diseases are caused by virus and which are caused by bacteria?**

Ans. **Virus**: "It is a small unicellular microorganism that contains either DNA or RNA".

Size: The majority of viruses measure between 10-400 nm (0.01-0.4 µn) and are therefore too small to be seen with light microscope. But they can be studied with electron microscope.

Dependence on Host Cells: As virus has no cellular structure and cell organelles thus it is unable to make its own proteins anti essential enzymes. It is therefore completely dependent on its host cell for energy and replication. Outside living cell, it is metabolically inactive. The information contained m virus's nucleic acid is used by a host cell to produce new viruses.

Structure of Viruses: All viruses consist of a mass (core) of single or double stranded DNA or RNA surrounded by a protective protein coat called a capsid. The nucleic acid and capsid form nucleocapsid.

Capsid is 'antigenic" and contains receptors which enable a virus to attach to the surface of it specific host cell. It consists of a number of identical units called "capsomers". Capsid has 3 types of symmetry which is used in virus classification:

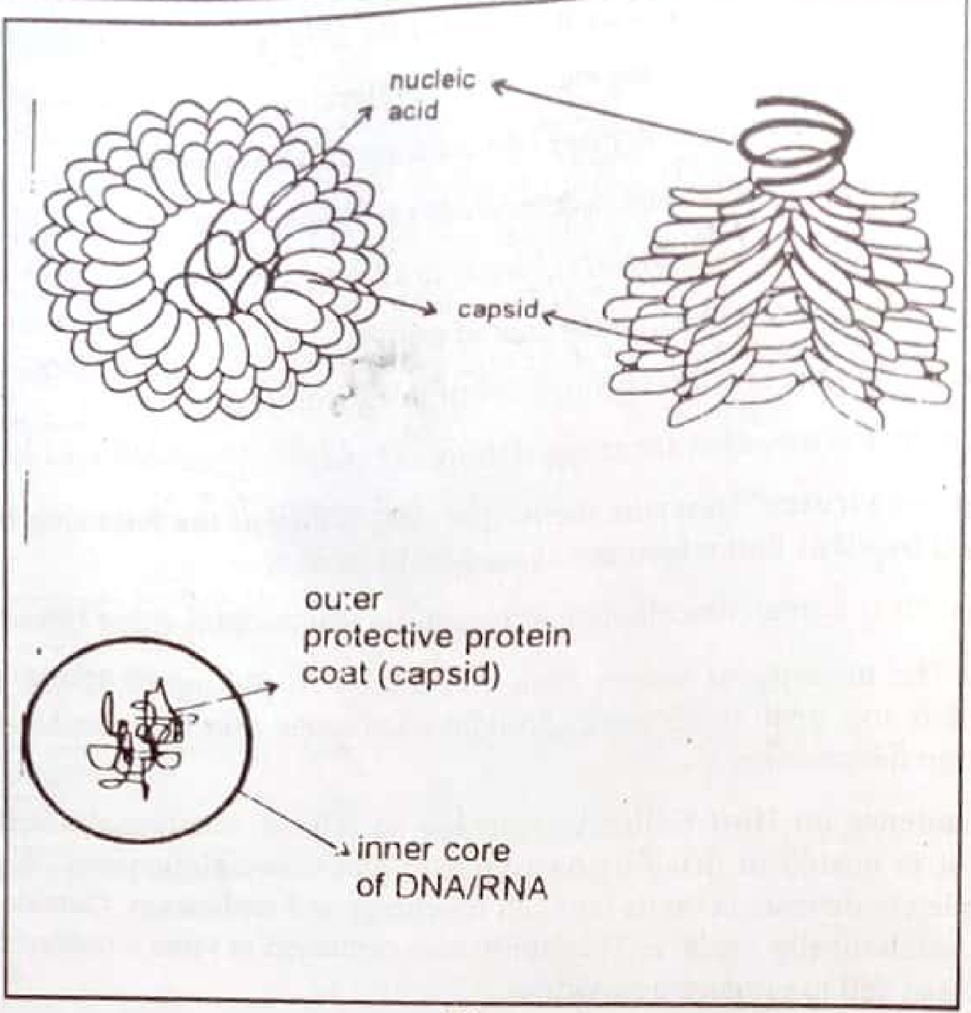


Fig:

(1) **Icosahedral:** Capsid has 20 equal sides and overall virus shape is spherical.

(2) **Helical**: Capsid is spiral which surrounds spiral shaped core of nucleic acid. Virus may be spherical/elongated/filamentous/pleomorphic.

(3) **Complex**: Capsid which is neither of above type and overall virus shape is brick-like.

Types of Virus:

(1) RNA Viruses

e.g.
- Yellow fever virus e.g.
- Rubella virus
- Ralies virus
- Mumps virus
- Measles virus
- Para influenza virus
- Polio virus
- Influenza virus
- HIV virus
- Hepatitis A virus

(2)
- Herpes virus
- Adeno virus
- Varicella zoster
- Virus
- Cytomegalovirus virus
- E.G. Virus
- Hepatitis B virus

	Disease	(Bacterial/Viral)
1.	Polio	⟶ viral
2.	Diphtheria	⟶ bacterial
3.	AIDS	⟶ viral
4.	Tetanus	⟶ bacterial
5.	Smallpox	⟶ viral
6.	Measles	⟶ viral

Q.9. Name the 3 major parts of human brain and the function they control. Make a rough labelled diagram of the brain.

Human Brain:

Ans. **(See Ch. 2, portion of Brain)**

Q.10 Give brief answers of any five?

(a) **Name the 2 proteins found in milk:**

1. Casien
2. Lactin

(b) **Which organ of human body controls the amount of water and salt in body?**

Ans. Kidneys control the amount of salt and water. These are 2 in number — Right and Left, present on the posterior abdominal wall, pear shaped and brownish red in colour.

"Nephron" is their structural and functional unit. There are about 1 million nephrons in each kidney.

Nephron: it consists of following parts:

— Brownian's capsule

— Proximal convoluted tubule

— Loop of Henle

— Distal convoluted tubule

— Collecting duct

Boumann's capsule has a tuft of capillaries in its convexity called as glomerulus through which the exchange of materials takes place,

(c) **Drugs are classified in 5 major groups, name any 2.**

1. Antibiotics
2. Corticosteroids

(d) **How do chromosomes in a male & female differ in human body?**

• There are 23 pairs of chromosomes in each human cell. Out of these 22 are "autosexual" that are same in both male and female while the 23rd pair is called as "sex chromosomes" that is different in male and female.

In male it is represented as XY.

And in female it is represented as XX.

(c) **Which gas do you exhale more than you inhale?**

(f) **Name any 2 glands which secrete hormones in human body.**

1. Pancreas (Insulin)
2. Thyroid (Thyroxin)

[redacted]

Q. 11. Explain briefly. (2.5 each)

Ans. Formation of a Rainbow:

Definition:

"A rainbow is the appearance of the band of seven colour spectrum on the horizon."

White Light:

Although the sunlight appeal's to be white but it is infact made up of 7 different colours, e.g. a rotating pulley with 7 colours.

Formation:

A rainbow is formed when this white light gets dispersed by passing through millions of falling spherical rain-drops which act as series of prisms.

Occurrence:

It usually occurs after a rainfall when there are numerous water drops hanging in the atmosphere.

Discovery:

This mechanism was discovered by "Newton" who passed the white light (polychromatic) through the prism and it broke out into seven colours. It is named as spectrum.

Order of Colours in Spectrum:

VIBGYOR

V = Violet
I = Indigo
B = Blue
G = Green
Y = Yellow
O = Orange
R = Red

Types of Spectrum:

1. **Visible Spectrum:**
   It contains 7 colours in an order of VIBGYOR.

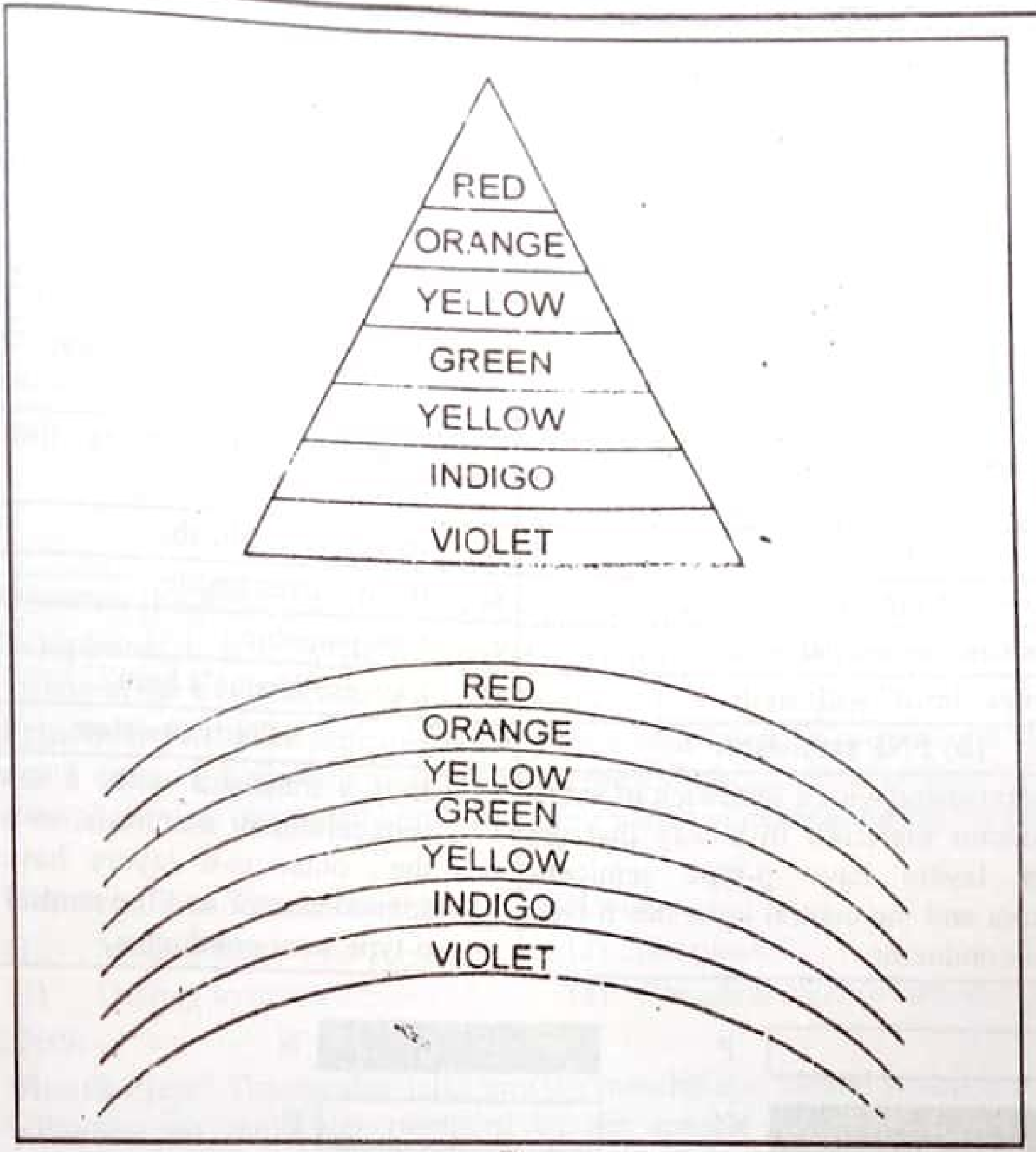


Fig.

2. **Invisible Spectrum:**
   It is present above violet and below red colours regarding the wavelength of light.
   (i) e.g. Ultra violet rays.
   (ii) Infra red rays

3. **Continuous Spectrum:**
   It contains all the 7 colours of polychromatic light in an ordered way. (VIBGYOR)

4. **Line Spectrum:**
   It is not a continuous spectrum and consists of bright lines separated by dark patches in between. It is used for the identification of elements.

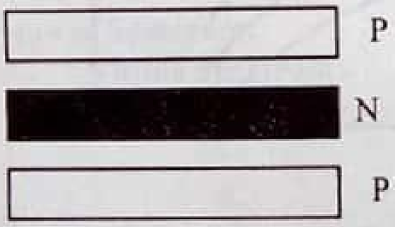
Q.12. Differentiate between any 5 of the following: (1 each)

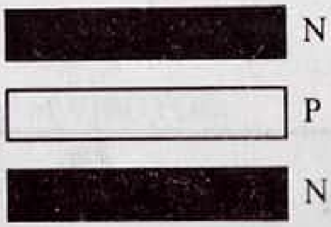
(a) Arteries

(a) Arteries	Veins
1. Arteries are the blood channels that carry oxygenated blood in them, away from the heart, towards the periphery.	1. Veins are the blood channels that carry deoxygenated blood in them, towards the heart, away from the periphery.

2. The only exception is pulmonary artery that carries deoxygenated blood from right ventricle to lungs.	2. The only exception is pulmonary vein that carries oxygenated blood from lungs to left auricle.
3. The great artery is "Aorta" that arises from left ventricle	3. The great veins are superior and inferior vena cava that carry blood into right atrium.
4. Artery divides into "branches".	4. Vein divides into "tributaries".
5. Its abnormal dilatation is called "aveurysm".	5. Its abnormal dilatation is called "varicosity".
6. The wall of artery is thick & muscular.	6. The wall of vein is thin & less muscular.
7. Its colour is reddish.	7. Its colour is bluish.
8. It doesn't have valves.	8. It has valves inside
9. Its pulsations are palpable.	9. Non-palpable.
10. It gives "bruit" with steth.	10. It gives "Venus's hum".

(b) PNP transistor	NPN transistor
1. It is transistor with a sandwich of semi-conductor materials in a way that the outer layers have p-type semiconductors and the central layer has n-type semi-conductor.	1. It is a transistor with; a sandwich of semiconductor materials; in a way that the, outer two layers have:: n-type semiconductor and the central layer has p-type semi-conductor.





Doping is a process in which impurities are added to a semi-conductor to boost up its efficiency.

Impurities: (1) Electron donor n —type
(2) Electron acceptor p — type

Semi-Conductors:

(1) N-type are made by doping electron rich metals like arsenic into pure silicon.
(2) P-type are made by doping electron deficient metals like Boron into pure silicon.

Significance:

(1) Transistor is a basic unit of all electrical appliances.
(2) It amplifies the flow of current.
(3) It has a small size against vacuum tube.
(4) It does not heat up.

(c) Electronic Current	Static Current
1. This is electricity in motion.	1. This is electricity at rest.

2. It involves flow of electrons.	2. It dos not involve flow of electrons.
3. It has high voltage	3. It has low voltage. Convex Lens
(d) Concave Lens	**Static Current**
1. It is the lens which is narrower in the centre and broader towards the corners.	1. It is the lens which is narrower towards the corners and broader towards the centre.
2. When a beam (if light strikes a concave lens all the rays after passing through it diverge.	2. Converge a single point.
3. It gives mostly virtual images.	3. Mostly real images except when the ray of light passes through it when object is placed b/w optical centre & focus.

Q.13. Describe the principle, construction and working of Telephone?

Ans. **Telephone**: It is a device for reproducing sound at a distance from its source by means of the transmission of an electrical signal.

Principle: The basic principle is using the sound vibration to control a larger source of power and creating a variable resistance in electrical circuit. This is done by making an electric current varying in intensity precisely as air varies in density during the production of sound.

Construction: The essential parts of a telephone

(1) Mouthpiece
(2) Ear piece
(3) Dialing system
(4) Complete electric circuit

WORKING:

1. **Mouth Piece:** The speaker talks into the mouthpiece, behind which is a transmitter. Vibrating air molecules produced by the speech generate vibrations in a thin aluminium diaphragm. These vibrations are transmitted to a small piston which is the cover for a metallic box filled with small granules of carbon. Electrical contact is made only through the carbon which is a good conductor of electricity. Vibration of piston causes the electrical resistance of carbon grains to vary and the amount of electricity passing through the circuit also varies and hence through the conducting line.
2. **Ear Piece:** It is at the receiving end. A sound membrane is made to perform vibrations similar to the one induced in the ear piece.
3. **Dial/Touch-Tone:** It sends out an electrical code that establishes the correct connection.
4. **Electrical Circuit:** A telephone operates as part of a complete electrical circuit. Thus it needs a power source, (50 volt battery) a conductor, and a switch.

Modes of transmission of telephone signals,

There are the electrical signals transmitted by;

(1) Through cables
(2) Radio relays
(3) Microwaves
(4) Optical light waves

Q.14. Describe briefly: (1 marks each)?

Ans. ECOSYSTEM:

Ecosystem is like a machine with certain inputs and outputs, while input is according to the object of management.

(ECO → OIKOS → home)

It can be defined as an aggregation of biotic factors interacting with abiotic factors.

Components:

ECOSYSTEM

A. Abiotic factors
(Non-Living Things)
Geosphere (soil)
Hydro sphere (water)
Atmosphere (air)
Igneosphere (sun)

Producers (plants)
Consumers (animals)
Predators
Decomposing Bacterial

Example:

(1) **Desert Ecosystem:** Sand is a dominant factor.
(2) **Forest Ecosystem:** Trees are the dominant factor.
(3) **Marine Ecosystem:** Water is the dominant factor.

DIFFUSION

Definition:

"The movement of molecules or ions in a solvent from an area of its higher concentration to the area of lower concentration is called diffusion".

e.g. (1) If a bottle of perfume is opened in a room its smell will be distributed throughout the available space in the room.

(2) If a crystal of $KMnO_4$ (solute) is placed in water (solvent) it is dissolved and its molecules or ions move & get evenly distributed throughout the water.

(3) Diffusion is responsible for multiple processes taking place in unicellular organisms.

Q.15. Explain what is meant by Non-Conventional sources of Energy". Describe any 3 of these:

Ans. (See Chapter 1)

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Q.1. Which of the following statements are true and which are false?

(1) Gyptogerms are non flowering plants (True)

(2) Reserve food material is usually stored as Glycogen in plants. (False)

(3) Streptococcus is a gram –ve bacterium. (False)

(4) Spinach is a good source of vitamin C. (True)

(5) Insulin is a hormone secreted by spleen. (False)

(6) Fever is a bone of a forearm. (False)

(7) The moon has no atmosphere. (True)

(8) Excessive burning of fossil fuel cause acid rain. (True)

(9) 21st of June is the longest day of the year in the North. (True)

(10) Electricity is the secondary source of energy. (True)

Q.2. Define any FIVE of the following terms:

(a) Doping:

"It is a process in which slight traces of impurities are added in the pure semi-conductors to boost up their properties." It facilitates the flow of electrons.

There are 2 types of impurities:

(1) Rich in $\bar{e}$ s = electron donor
= n-type

(2) Deficient in $\bar{e}$ s = electron-acceptor
= p-type

Examples:

1. n-type = Silicon + Arsenic
2. p-type = Silicon + Boron.

(i) ***n-type semiconductors*** are made by doping rich metals like arsenic into the pure silicon.

(ii) ***p-type semi conductors*** are made by doping with deficient metals like Born into pure silicon.

(b) Immunization

"It is a process of protecting the body against disease by means of vaccine or resumes."

Types:

1. Active Immunity, 2. Passive Immunity.

Resumes (Immunoglobulins) furnish immunity by adding anti bodies directly to the blood. *(Active Immunity)*

Vaccines provide immunity by causing the body to manufacture anti bodies in response to antigenicity of vaccine, which fight against disease. *(Passive Immunity)*

(c) Pasteurization

"It is a process which involves rapid heating of the milk under pressure to 125–150°C for a few seconds only which is then rapidly cooled and bottled."

Merits

1. It preserves:

— taste, — flavour

— Appearance — Digestibility

(2) It wills specific harmful organisms.

(3) It delays the natural sowing of milk by 12 to 24 hours.

Origin

It was discovered by a French scientist "Hours Pasteur" and is named after him.

It is a preventive measure of public health importance.

(d) **Modulation**

"It is a process in which sound or vision are converted into *electric pulse* and are catalogued with *carrier wave* of electro magnetic radiation of transmission."

Significance

It is a basic principle of Radio and TV, followed by "demodulation" that is exactly reverse of it.

Example

At Radio Station, the speaker speaks and his sound undergoes compression and rarefaction, the receiver catches it and converts it into an "electrical pulse" that passes through cables. It is then converted into electromagnetic radiation that is transmitted through the antenna of Radio Station in the environment.

From air, our home antenna receives these. EM radiations and convert them again into sound waves that we can hear from our Radio-set.

(e) **Catabolism**

"It is the set of metabolic reactions in which break down of bigger organic molecules (food) occurs into unstable smaller chemical components."

Example:

The break down of principle nutrients of food.

— Carbohydrates — Fats

— Proteins

Mechanism

It takes place in 3 phases.

(1) **First Phase**

— Fats ⟶ fatty acids + glycerin

— Proteins ⟶ Amino Acids.

(2) **Second Phase**

Glucose

Fatty acid + Glycerin ⟶ Acetyl Co Enzyme (3-C compound) Energy ↑

Amino Acids

(3) **Third Phase**

Acetyl Co Enzyme ⟶ $CO_2 + H_2O$ + Energy + (ATP) ↑↑

ATP "Adenosine Tri Phosphate"

This molecule is a basic unit in metabolism.

During catabolism, energy is captured from an organic material and transformed into ATP.

Anabolism

It is a metabolic process that is reverse oft; catabolism.

(f) Reprocessing of Reactor Fuel

"It is a process in which the fissionable product is recovered from the spent nuclear reaction fuel by chemical dissolution."

Demerit

It generates *"Nuclear Waste"* that is *highly radio active* and hazardous for health. It has radio active Ba and Kr. It can be disposed off by;

— recycling — sending into space

— burial under a sea bed.

Q. 3. Fill in the blanks:

(1) The largest planet of the solar system is ***Jupiter***.

(2) The outermost layer of Earth is called ***crust***.

(3) Newton is a unit of ***Force***.

(4) Radium was discovered by ***Madam Curie***.

(5) The memory of the computer is expressed in ***C.P.U.***

(6) *Qurtz* is a crystalline form of ***silicon dioxide***.

(7) Aids is caused by ***Human Immune deficiency Virus (HIV)***

(8) Chemical name of Gypsum is ***Calcium Sulphate***.

(9) Molten super hot material present inside a volcano is called ***lava***.

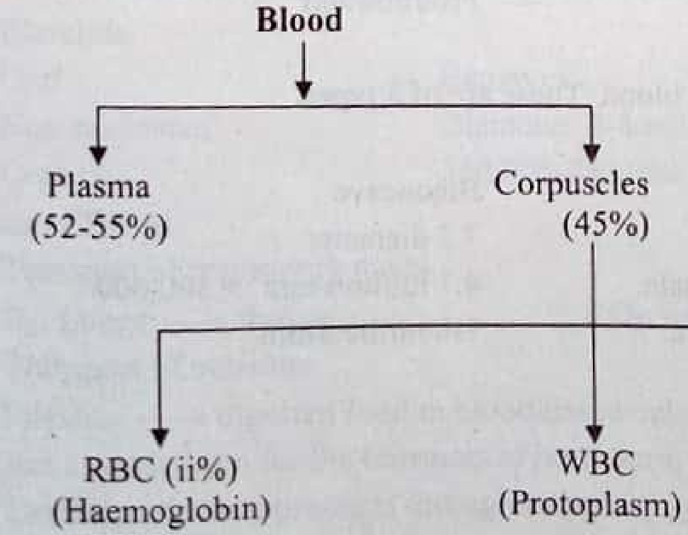
(10) Ritcher scale measures the severity ***of Earthquake***.

Q.4. What is the composition of blood? Describe six main functions of blood:

Ans. Blood:

"It is a vital connective tissue fluid of the body."

Composition:



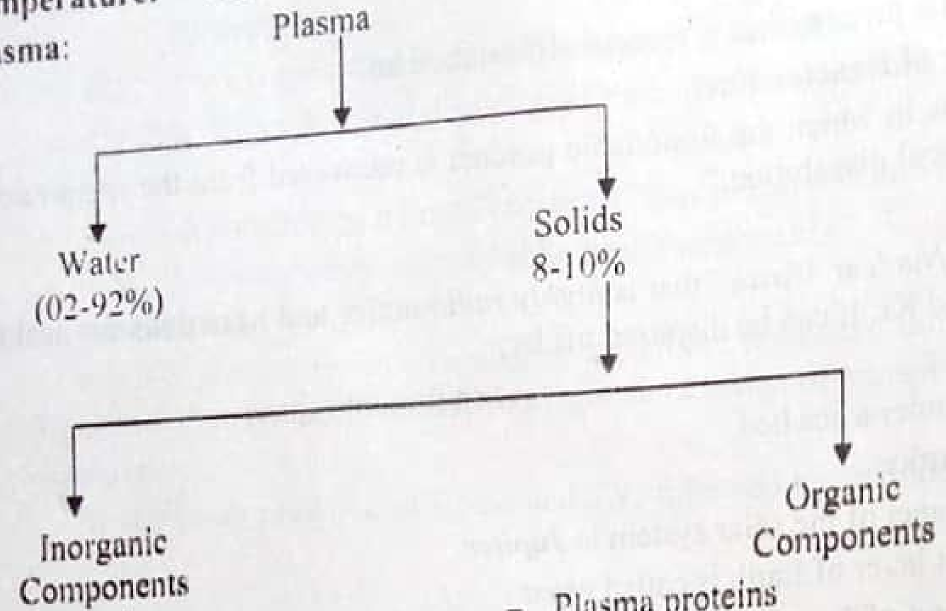
PH: 7.45 ⟶ 7.35 (alkaline)

Volume: 5.5 litres. ($^1/_{10th}$ of total body weight)

Colour: Red (due to Haemoglobin)

Temperature: 98.3 °F (normal)

Plasma:



Inorganic Components

- Na^+
- K^+
- Ca^{++}
- Mg^{++}

Organic Components

- Plasma proteins
- Carbohydrates (Glucose)
- Fats (Neutral fat, Plispholipia cholestrol)
- Non-Protein Nitrogenous substances area, uric acid, Amino Acid, Ammia
- Colouring Matter Bilirubin, Carotens.
- Enzymes.
  Amylase
  Lipase
  Protease
  Phosphates

Plasma Proteins

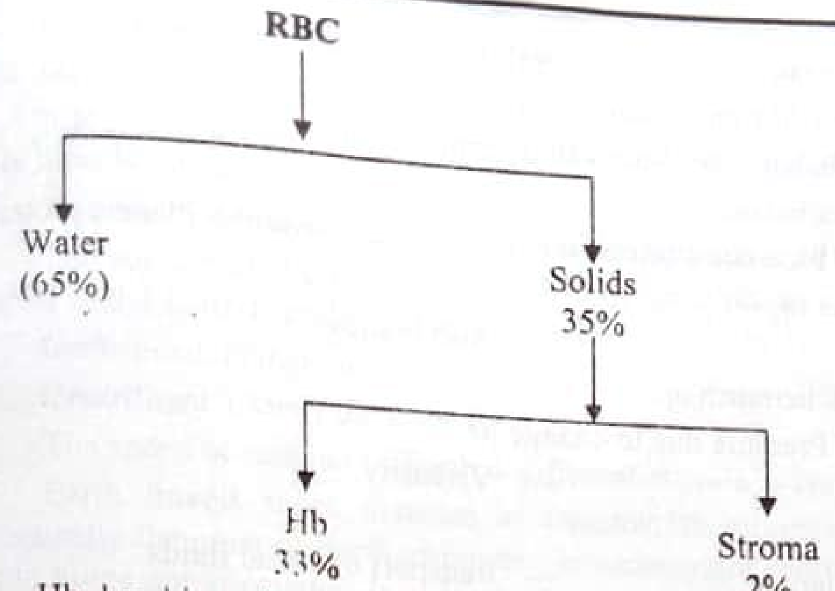
- Albumin
- Fibrinogen
- Globulin
- Prothrombin

Blood Corpuscles

They remain suspended in the blood. These are of 3 types.

(1) RBC

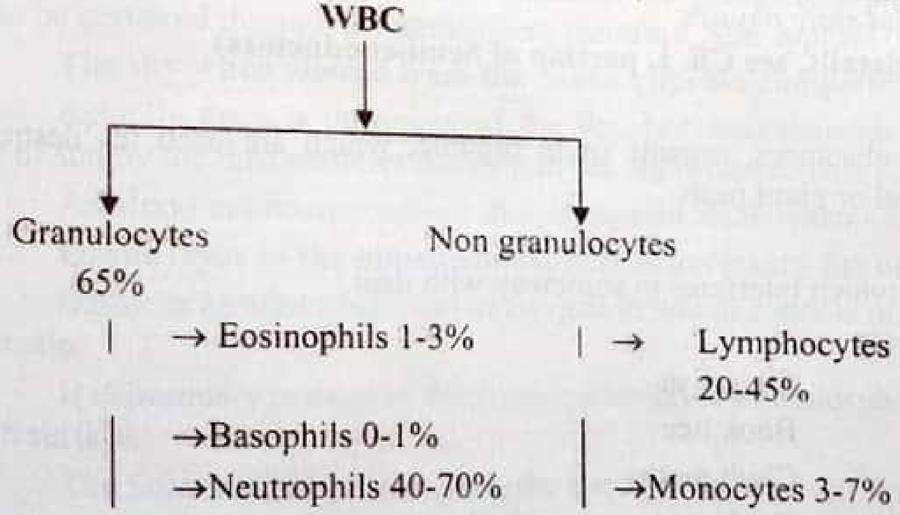
Circular	Biconcave
Non-nucleated	7.2 diameter
Average no in adult female.	4.7 million/mm^3 + 300,000
Average no in adult male.	7-8 million/mm^3



Hb. level in male = 16 gm%
Hb level in female = 12-14 gm%

(2) **WBC**

No hemoglobin	Nucleated
Greater size	Lesser in number (4000 – 11000/mm^3)



(3) **Platelets**

Oral	Biconvex
Non-nucleated	Diameter: 2-4 microns.
Count:	250,000-450,000/mm^3

Functions of Blood

(1) Transport of respiratory gases.
O_2: Lungs ⟶ tissues CO_2; tissues ⟶ lungs

(2) Transport of nutrition.
Intestine ⟶ digested food in blood tissue cells.

(3) Act as a Medium for the transport of hormones, vitamins + other chemicals.

(4) Drainage of waste products through excretory system.

(5) Regulation of body temperature as it has.

— High specific heat. — High thermal conductivity.
— High latent heat of evaporation.

(6) Maintenance of Ion balance between cell & remedy fluid.
(7) Maintenance of water balance.
(8) Maintenance of acid base equilibrium, due to buffering power by Plasma proteins.
(9) Defensive Action due to
— WBC — Anti bodies.
(10) Coagulation prevents hemorrhage.
(11) Regulation of Blood Pressure due to change in
— Volume — Viscosity.
(12) Plasma Proteins.
— helps in coagulation. — transport of tissue fluids.
— helps in unity.

Q.5. Write short notes of 150 words each on any 2 of the following.

(a) Semi Conductors

"These are the materials through which the electricity is passed partially and their conductivity is in between conductors and insulators." Their functioning involves the science of *solid state physics.*

(For details, see Ch. 1, portion of Semi-conductors)

(b) Pesticides:

"These are the substances, organic or in organic, which are used to 'destroy or inhibit the action of animal or plant pests."

Pest:

It is an organism which interferes in someway with man.

Common House hold Pests

Mosquitoes
Flies
Bed bugs
Cockroaches
Carpet beetles
Flee
Silverfish
Book lice
Cloth moths
Crickets
Tick

Ans. (For details, see Ch. 1, portion of Pesticides)

(c) Properties of Laser

"It is a device which generates well organised and coherent light, with essentially a single frequency."

Ans. (For details, see Ch. 1, portion of Laser)

Q.6. Write short notes on any 2 of the following scientists (each in 100 words)

Ans. (a) Ibn Al-Baitar

Ans. (See Appendices)

(b) Al-Biruni

Ans. (See Appendices)

Q.7. Give brief explanation of any five:

Ans. (a) The Earth bulges out at the equator

It is one of the effects of "Rotation of Earth" which is the movement of Earth around its axis from West to East in 24 hours.

The polar diameter of Earth is 7900 miles while that of Equator is 7927 miles.

The surface of the Earth is not one solid part but is made up of 15 tectonic plates. The crust of the Earth is under 2 types of forces.

(1) Centripetal. (Towards the centre)

(2) Centrifugal. (Away the Centre)

The speed of rotation of Earth is different at polls as compared to that at Equator.

Earth travels more distance at equator; therefore, its speed is slowed down. Consequently the crust of Earth at Equator is under more centrifugal force which makes the Earth to bulge out at equator. It is due to this reason polar diameter of Earth is less than that of equatorial diameter.

(b) The Sun appears red at sunset and sunrise:

Ans.

At sunset and sunrise we see the sun, therefore, the greater thickness of air because it is low in the sky. The colours of the spectrum are gradually scattered. Red and orange are last to be scattered through the atmosphere therefore, Sun appears organised red.

(c) The sky when viewed from the Moon appears completely black:

Actually there is no colour of the sky. It colour depends upon scattering of white light of sun by the dust particles hanging in the atmosphere. This is called "Tyndall Effect."

As Moon has no atmosphere thus it appears black when viewed from the Moon.

(d) Ozone layer in the upper atmosphere is necessary for our survival:

Ozone is an allotropic form of oxygen in which 3 atoms of oxygen are present in one molecule.

It is normally present in the stratosphere layer of atmosphere about 20 km above the Earth surface.

The Solar radiations that reach the Earth's surface from the Sun have to pass through this ozone layer before reaching the Earth.

The ozone layer checks the entry of harm radiations such as UV rays and prevent their entry.

If these hazardous rays enter the atmosphere (through ozone hole) they cause.

- Skin cancer in humans
- Kill animal & plant life
- Effect crop yield e.g. cabbage, squash, soybean.

(e) Australian continent has winter season when we have summer season in Pakistan:

Australian continent is present in Southern Hemisphere while Pakistan is in Northern Hemisphere.

Our Earth presents 2 types of movements:

(1) Revolution (365.25 days)

(2) Rotation (24 hours)

Earth has an axis that passes through its centre. It is titled to a certain extent and makes an angle of 66.5° with a horizontal and 23.5° with a vertical.

Thus the reasons in the Northern and Southern hemisphere are opposite to each other.

— For Northern Hemisphere:
Spring equinox: 21st March.
Autumn equinox: 22nd September.
Summer Solastice: 21st June
Winter Solastice: 22nd December

— For Southern Hemisphere it is exactly opposite.

For example in summer June is the longest day in Pakistan but the shortest clay for Australia. Although at that time Earth is 1 million miles away the sun as compare to that in winter of Pakistan. Thus the control of seasons doesn't depend on distance between Earth & Sun but on direction of radiations of sun, that are almost vertical over Northern Hemisphere and slanting over Southern Hemisphere, at that very time.

(f) Roads are bent inward on curves:

Ans. To balance the centripetal force with that of force. Otherwise the vehicle may go out of control.

Q.8. Classify the following animals as: Ans.

Reptiles	Mammals	Birds	Fish
Cobra	Blue Whale	Ostrich	Shark
Alligator	Panda	Kiwi	
Tortoise	Penguin Dolphin		

Q.9. Name all the organs of human excretory system. Drew a labelled diagram and explain the functions of each organ.

Ans. ORGANS OF HUMAN EXCRETORY SYSTEM. Right

1. Kidney — Right / Left
2. Ureter — Right / Left
3. Urinary Bladder
4. Urethra.

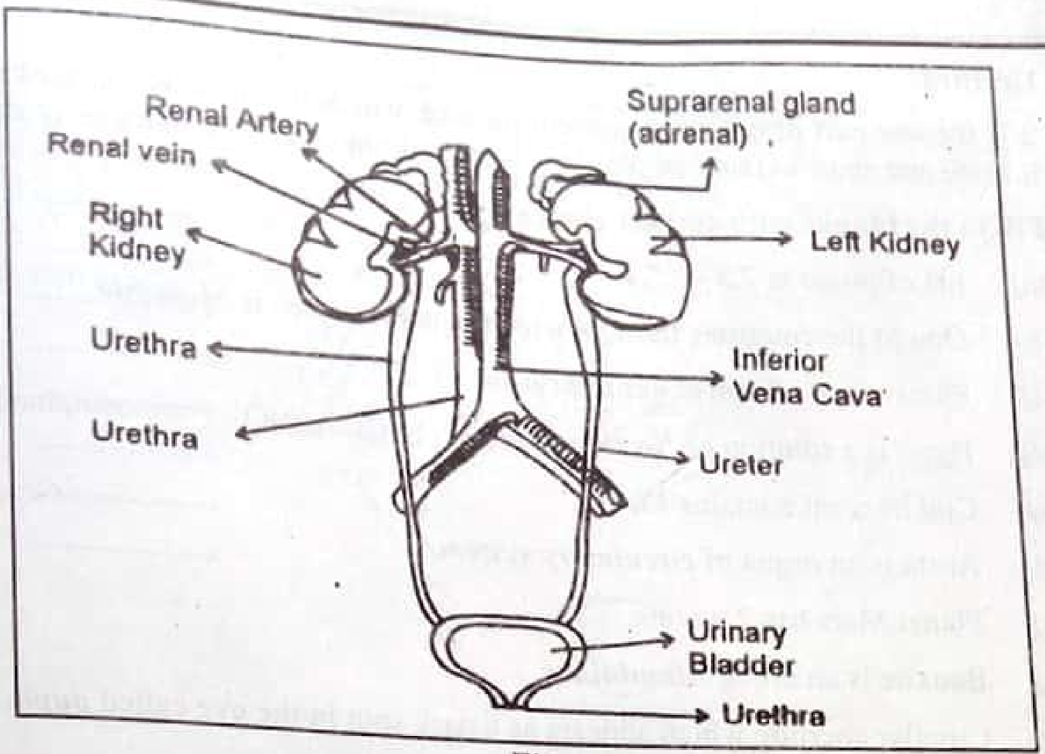


Fig.

FUNCTION OF EACH ORGAN

(1) Kidneys

There are 2 dark red-brown, bean shaped kidneys situated at the back of the abdomen, one on each side of lumber vertebrae. Each kidney is 4" long, 2.25"broad and 1.5" thick. It weighs 4.5 lbs. Its concave surface is towards vertebral column. The right kidney is usually shorter, lower & thicker than left due to downward extension of right lobe of liver,

Renal Arteries (brs of Aorta) supply it blood while *Penal Veins* (Tributaries of IVC) take away blood from them.

Each kidney has about one million nephrons. Each *nephron* begins as a dilated spherical end *"Bowmam's Capsule"* which has tuft of capillaries at its month called *"glomerulus"*. Its later parts are:

- — Proximal convoluted tubule
- — Loop of Henle
- — Distal convoluted tubule
- — Collecting duct:

It receives waste products like urea and uric-acid from the blood and maintains the electrolyte balance.

(2) Ureters

These are thin tubings that connect kidneys with urinary bladder. Each kidney has one ureter which act as channel through which urine passes from kidney to bladder for storage.

(3) Urinary bladder

It is a bag like organ, meant, to store the urine before voiding. It is present in lower abdomen and pelvis. When it is filled to its maximum Capacity, the urge to micturate is initiated and thus the act of voiding of urine is under taken'.

(4) Urethra

It is the last part of excretory system through which the urine is excreted out of the body. It is wide and short in females. While it is curved, thin and long in males (J shaped)

Q.10. Fill in the blanks with correct choice:

(a) pH of blood is *7.3 — 7.4.*

(b) One of the countries through which equator passes is ***Malaysia***.

(c) Purest form of iron is ***wrought iron.***

(d) Hypo is a solution of ***Na-thiosulphate*** (NaCl, AgNO$_3$, Nathiosulphate)

(e) Cod liver oil contains ***Vit D.***

(f) Aorta is an organ of ***circulatory system.***

(g) Planet Mars has *2* moons.

(h) Bauxite is an ore *of **Aluminium***.

(i) Circular aperture which appears as a dark spot in the eye called ***pupil.***

(j) The most distant planet in the solar system is ***Pluto***.

Q.11. Match the scientists and their discoveries:

(1) Einstein ⟶ Mass energy conversion equation.

(2) Roentgen ⟶ X-Rays.

(3) Charles Darwin ⟶ Theory of Evolution.

(4) Chadwick ⟶ Neutron.

(5) Mendel ⟶ Laws of heredity.

Q.12. Write an essay (200 words) on the variation of apparent Moon size:

Ans. Variation of Apparent Moon Size

The *Moon's orbit* around the Earth is elliptic and it is inclined 5^{C} to the plane of Earth's orbit around the sun. It means that the orbit of Moon and Earth are not in the same plane.

The *Equator of the Moon* is inclined 6° to the plane of its elliptic orbit. Thus 59% of Moon's surface is visible at different times from the Earth.

As seen from the Earth, the Moon passes through a *series of phases* after every 27.3 days:

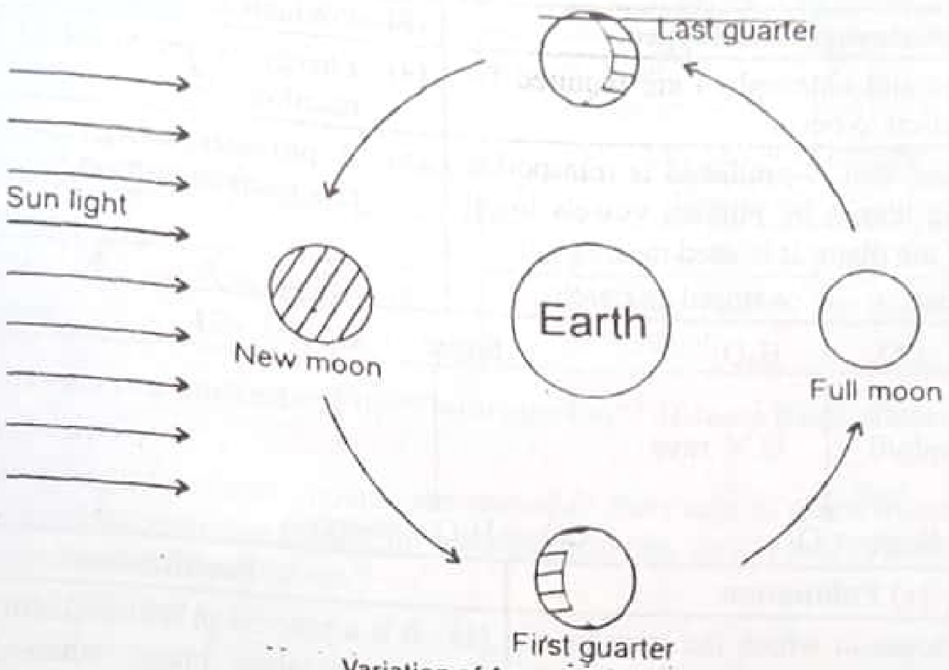
— Waxing from new Moon.

— Full Moon.

— First quarter.

— Warning to last quarter

— New Moon again.



Variation of Apparent Moon Size

Fig.

At *full Moon,* the Earth is between the sun and the Moon and the whole lunar disc facing the Earth is completely illuminated.

At *new Moon,* the Moon is between the sun and the Earth, and the rays illuminate only the hemisphere facing it, learning the side facing the Earth in complete darkness, making it invisible from the Earth.

Q.13. Differentiate between the following terms:

(a) Hypoglycemia	**Hyperglycemia**
(1) It is the fall in blood normal limit. ***Normal Level:*** Fasting = 60-90 mg% Random = 120-140 mg%	(1) It is the rise of blood sugar level below its sugar level above its normal limit.
(2) Its symptoms are felt when the blood sugar level falls below -40 mg%.	(2) Its symptoms are felt when the blood sugar level rises above 140
(3) Its effect are mental confusion gradiness visual disturbances syncope Coma Convulsion	(3) Its effects are blurring of vision weakness multiple infections calf pain frequency of mirturation unhealed wounds.
(4) It is treated by intravenous glucose therapy.	(4) It is treated by intra' venous insulin therapy.
(b) Photo synthesis	**Respiration**
(1) It is a process taking place in plants which uses CO_2 and water to make sugars,	(1) It is the process in plants and animals which provides energy for all other processes which must continue for the organism to live.

(2) Reactants are CO_2 and H_2O.	(2) Reactants are sugar + O_2
(3) Products are sugar and oxygen.	(3) Products are $CO_2 + H_2O$.
(4) UV rays and chlorophyll are required for the reaction to occur.	(4) Energy is produced at the end of reaction.
(5) The sugar that is produced is transported from the leaves by phloem vessels to all parts of the plant. It is used in — respiration — or stored as starch	(5) It provides energy to sun all the processes of body.

$$CO_2 + H_2O \xrightarrow[\text{Chlorophyll}]{\text{U.V. rays}} \text{Sugar} + O_2$$

$$\text{Sugar} + O_2 \longrightarrow CO_2 + H_2O + \text{energy.}$$

(c) Pollination	Fertilization
(1) It is a process in which the transfer of pollens takes place from male reproductive organ to female reproductive organ, in flowering plants.	(1) It is a process in which fusion of egg and sperm takes place when they come closer.
(2) It occurs by — Biological agents i.e. animal, birds, insects. — Physical agents i.e. wind, water.	(2) It occurs by physical mating of male and female.
(3) It occurs in flowering plants.	(3) It occurs in animals.
(4) The product of union is seed.	(4) The product of union is zygote.

(d) Herbivores	Carnivores
(1) These are the mammals that live by eating green fodder.	(1) These are the animals that live by eating flesh.
(2) Their teeth are designed to cut and chew leaves, plants and fodder.	(2) Their teeth are sharp & pointed to cut flesh.
(3) Their jaw movement is specialised for side to side motion.	(3) Their jaw movement is specific for up and down movement.
(4) Their digestive enzymes are specific to digest plant food thus their appendix is of large size.	(4) Their digestive enzymes are specific to digest flesh. They take green grass in case of GIT upset.
(5) During relaxation, they rechew the ingested food.	(5) They don't do rechewing.
(6) e.g. Cattle, goat, sheep, horse, donkey.	(6) e.g. **Dog, Cat, Tiger,** Lion.

(e) Epidemic	Endemic
(1) It is a disease that attacks great number of people in one place at one	(1) It is a disease that is always present to same extent in a particular locality.

time and itself travels from place to place.	certain areas or regions.
(2) It may be — contagious — Infections	(2) It is due to — insanitation — local deficiency of certain elements.
(3) It does not become endemic.	(3) It may flare up to become epidemic.
(4) Example:	(4) Example:
— Cholera. — Food Poisoning — Influenza — Chicken pox	— endemic goiter in areas with Iodine deficiency.

Q.14. What do you understand by "Deforestation"? Discuss its ill effects on mankind:

Ans. Definition

"It is the ruthless and unplanned removal of trees acts as green ironer to protect the Earth from erosion, provides habitat for wildlife, provides timber and fuel to man and plays role in soil and water conservation."

Ill-effects on mankind

Removal of trees, exposes soil to many environmental hazards.

Q.15. How do our domestic and industrial activities pollute water? Explain with reference to 2 important industries of Pakistan:

Ans. (See Ch. 1, portion of Fertilizers)

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Q. 1. Which of the following statements are?

Ans.

(a) Jabir Ibne Hayyan was the author of the book Kitab-ul-Manazir? (False)

(b) Abul Qasim Al-Zaharvi was a famous Muslim mathematician. (False)

(c) The speed of light is nearly 300,000 km/sec. (True)

(d) Ideally water can be used as a car fuel with electrolytes. (False)

(e) A machine helps us do more work with lens force. (True)

(f) Our eye is very sensitive to blue light. (False)

(g) We can receive T.V, sound signal on our F.M. radio sets. (False)

(h) Sound can travel through vacuum. (False)

(i) Famous Muslim botanist Ibn Al-Baiter lived during the period 700-900. (False)

(j) A ceramic engine would have greater efficiency. (True)

Q. 2. Fill in the blanks with the correct choice?

Ans. *(a)* Al Biruni died in **1048 A.D.** (848, 1048, 1248)

(b) Abu Ali Sina was born in **Turkey**. (Iraq, Turkey. Spain)

(c) **Blue** colour has shortest wavelength, (blue, yellow, green)

(d) **Copper** metal has the highest electrical conductivity, (silver, tungsten, copper),

(e) Light travels fastest in **vacuum,** (glass, vacuum, plastics)

(f) Our Solar system has about **50 satellites,** (35, 50, 96)

(g) The universe is **contracting,** (contracting, expanding, stationary)

(h) The disease Hemophilia is caused by the deficiency of vitamin **K**. (A, K, D)

(i) **Protein is a** natural polymer, (glucose, protein, polyethylene)

(j) **Astronomers** cannot be nominated for the noble prize, (physicists, economists, astronomers)

Q.3. Define any five of the following terms?

Ans. (a) Biogas:

Definition: It is a type of gas that is given off by dead and decaying animals, plants and rubbish, sewage & manure in swampy areas. It is mainly composed of methane gas.

(b) Geothermal Energy:

Definition: It is the type of energy that is derived from the heat of Earth (Geo-Earth, thermal — heat)

e.g. A water is pumped down in a pipe into the depth of Earth, it is heated up by the hot rocks in the core of Earth, turned mm a steam that is brought up by another pipe and is used to produce energy.

(c) Vaccine:

Definition: It is a suspension of the attenuated microorganisms, bacteria or virus, to protect the body against a specific disease by stimulating the formation of antibodies. It has antigenicity but no pathogenicity.

e.g. Polio vaccine.
Measles vaccine.

(d) Antibiotic:

Definition: It is a chemical produced by microorganism that has a capacity in small concentration to inhibit the growth (bacteriostatic) or to destruction (bactericidal) of the other microorganism.

e.g. Bacteriostatic antibiotic,
Tetracyclene Erythromycine, Chloroamphenicol, Bactericidal antibiotic, Penicillin, Cephalosporines, aminoglycosides.

(e) Ceramics:

Definition: These are the inorganic, non-metallic materials manufactured at very high temperature. It requires raw materials eg. clay, feldspar, Iron quartz sand.

e.g. Tile terra cota, Dinnerware.

(f) Light year:

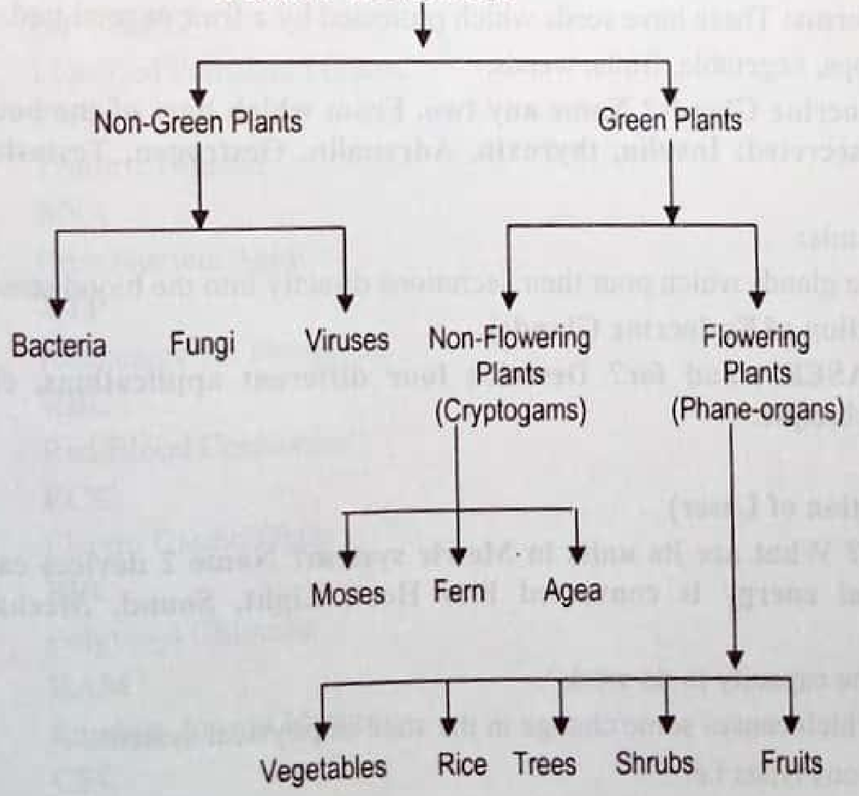
Definition: It is a distance travelled by the light m one year. It is equal to 3×10^5 km/sec, or 1, 86,000 miles/sec.

e.g. This unit is used to measure the distance between galaxies.

Q. 4. Briefly discuss classification of plants giving suitable example of each type?

Ans. CLASSIFICATION OF PLANTS

PLANT KINGDOM



Plant Kingdom:

There are about 2 million species of plants on the Earth. They require 3 basic ingredients to survive.

1. air 2. light 3. water

They make their own food using simple raw materials and energy from the Sun by "photosynthesis".

Non-Green Plants:

These plants have simple bodies without root, stem and leaves. They don't contain chlorophyll and hence don't involve photosynthesis. They can grow without sunlight.

e.g. bacteria fungi virus

Green Plants:

These plants contain chlorophyll and carry out photosynthesis. These have 2 types.

(a) **Non-Flowering Plants: (cryptogams)**

These are seedless green plants.

- They reproduce by spores.
- Simple structure except (ferns)
- Can't grow to any greater size,
- They have long life,
- Don't have supporting fibres.

e.g. Moses Ferns Algae

(b) **Flowering Plants: (Phanerogams)**

These are seed containing green plants.

These have further 2 sub-types:

(i) **Gymnosperms:** These have naked and unprotected seeds.

e.g. Pine, fir, cedar, spruce, cypress.

(ii) **Angiosperms:** These have seeds which protected by a fruit or seed-pod.

e.g. grass, crops, vegetable, fruits, weeds.

Q.5. What are Endocrine Glands? Name any two. From which part of the body are the following secreted: Insulin, thyroxin, Adrenalin, Oestrogen, Testosterone, Cortisol.

Ans. **Endocrine Glands:**

"These are those glands which pour their secretions directly into the blood stream".

(See Ch. 2, portion of Endocrine Glands)

Q. 6. What does LASER stand for? Describe four different applications, clearly stating their principle:

Ans. **LASER:**

(See Ch. 1, portion of Laser)

Q. 7. Define Energy? What are its units in Metric system? Name 2 devices each in which electrical energy is converted into Heat, Light, Sound, Mechanical Energy?

Ans. **Energy:** "It is the capacity to do work".

"It is an agent which causes some change in the state of physical systems".

- It has various types i.e.

Kinetic
Potential
Electrical
Nuclear

— All sources of energies are inter-convertible.

$E = mc^2$
E = Energy
M = Mass
C = Velocity of light

This equation shows that mass can be converted into energy and vice versa,

Unit of energy in Metric System:

"Joule"

Electrical Energy can be converted into:

Form of Energy	**Devices**
1. Heat	*(i)* Electric Iron *(ii)* Electric Oven
2. Light	*(i)* Electric Bulb *(ii)* Tube Light
3. Sound	*(i)* Electric bell *(ii)* Radio
4. Mechanical	*(i)* Electric motor *(ii)* Fan

Q.8. What do the following scientific abbreviations stand for?

Ans. (a) **LPG**
Liquified Petroleum Gases.

(b) **TNT**
Trinitro Toluene

(c) **RNA**
Ribo Nucleic Acid

(d) **ATP**
Adenosine Tri Phosphate

(e) **RBC**
Red Blood Corpuscles

(f) **ECG**
Electro Cardio Gram

(g) **PVC**
Polyvinyl Chloride

(h) **RAM**
Random Access Memory

(i) **CFC**

Chloro Fluro Carbons

Q. 9. Write short notes on any 2 of the following?

Ans. (1) Acid Rain:

Definition: It is a form of precipitate (rain, snow or hail), as a result of air pollution containing high levels of sulfuric acid, nitric acid and nitrous acid with a pH less than 5.5.

(For details, see Ch. 3, Acid Rain)

(2) Ozone Depletion:

Ozone: It is an allotropic form of oxygen which has three atoms of oxygen (O_3) in each molecule. This enriched oxygen is present naturally in the stratosphere as "ozone layer". It is formed from diatomic Oxygen by an electric discharge or exposure to UV radiation.

$$3O_2 \xrightarrow{U.V.} 2O_3$$

Ozone Layer: It is present between 15 to 30 km from Earth's surface in the region of stratosphere. It protects us from high energy UV rays of the Sun which will otherwise kill living things.

Ozone Depletion: Some man made chemicals are eating away that crucial shield of Ozone by various chemical reactions that convert it back to molecular O_2. This is called as "Ozone Depletion" or "Hole in the Sky", ft was for the first time noted over Antarctica in 1985 of the size of USA and the depth of Mount Everest. This Antarctic hole develops every year in September & October.

October. During that period O_3 contents fall by 40% in stratosphere.

Main Culprit for Ozone Depletion: Chloro Fluoro Carbons (CFCs).

These are used in (1) aerosol cans, (2) air-conditioner.

At ground level these gases are cheap & non-polluting but in stratosphere they deplete O_3.

$$O_3 + x \xrightarrow{\text{High voltage}} O_2 + Ox$$

$$Ox + O \longrightarrow x + O_2$$

(x = OH, NO, Cl, Br etc.)

Effects of O_3 Depletion:

Since O_3 absorbs biologically damaging UV rays before it can reach the Earth's surface thus O_3 depletion causes increased exposure to UV rays;

1. Skin cancer in human beings.
2. Decreased immunity in human body,
3. Decreased yield of crops.
4. Global w arming.
5. Increased Urban air pollution through photolysis of formaldehyde, a common component of photo-chemical smog.

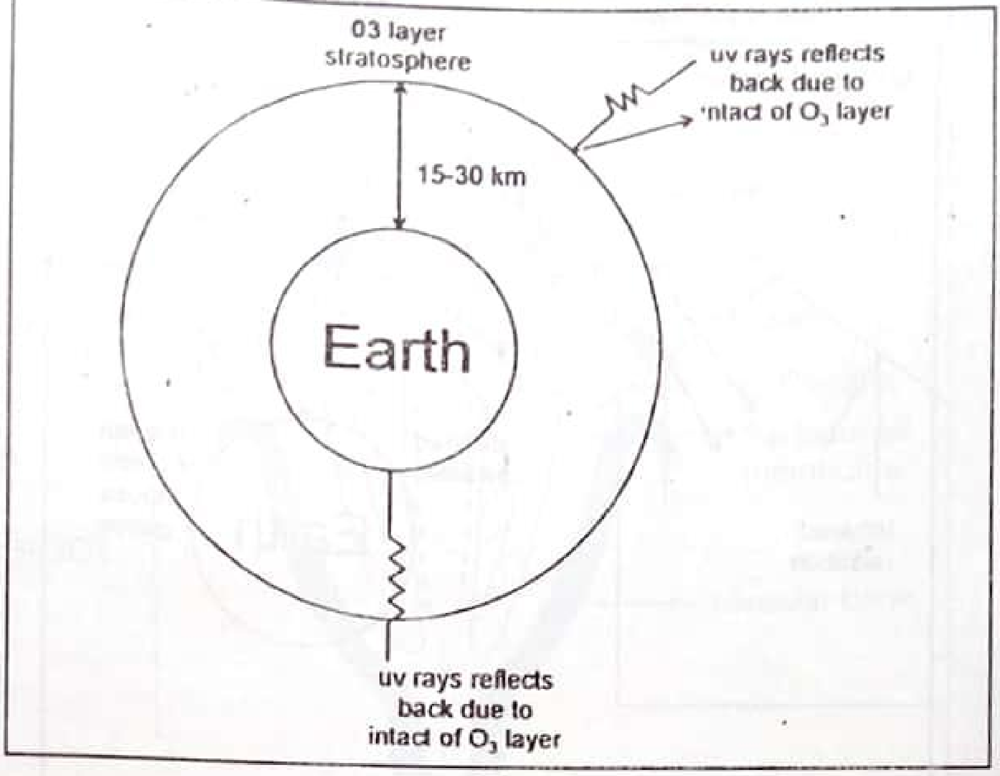


Fig.

(3) Green House Effect:

Ans. (See Ch. 3, Green House Effect)

Impact of Green House Effect:

1. **Global Warming: Average global** temperature would rise 1.5 °C → 4.5 °C during the next 4 years.
2. There will be more frequent flood due to the melting of polar ice, it would submerge coastal cities.
3. Dwindled rice harvest.
4. Drying of oil in summer.
5. Destructive Droughts.
6. More violent hurricanes and tornadoes
7. Deforestation.
8. Wild life would migrate or perish.
9. Deep peat lands would decompose & release amount of CO_2, and CH_4.

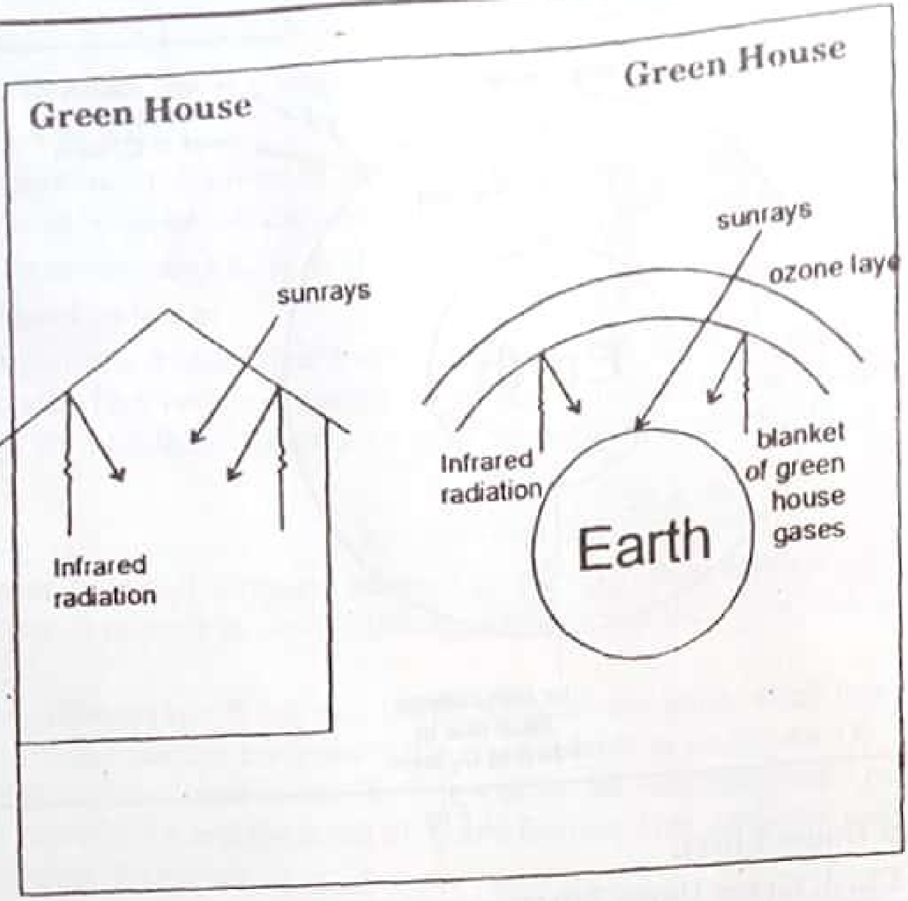
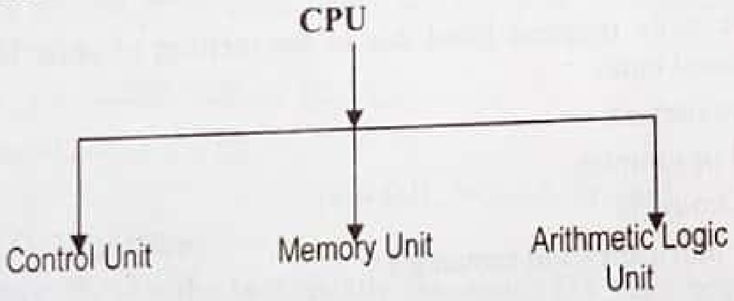


Fig.

Q. 10. What are the 3 components of CPU in & computer? What is the formation of each?

Ans.



CPU: "Central Processing Units"

It is a brain of a computer. Once the data is entered, it is transferred to CPU. It has 3 parts:

(i) **Control Unit:** It controls what happens.

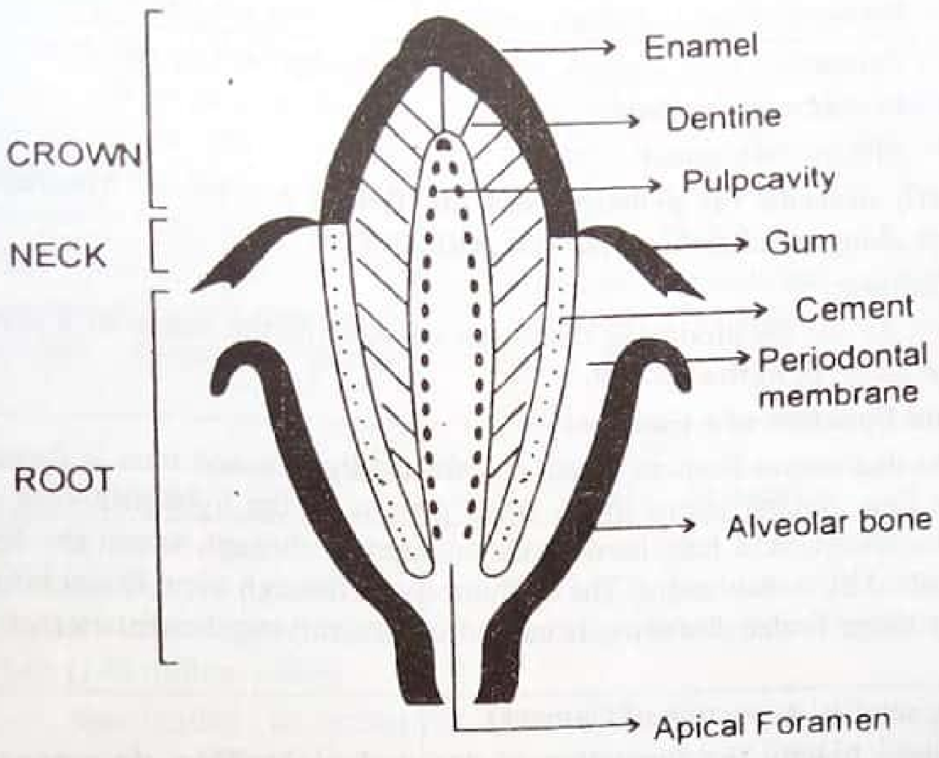
(ii) **Memory Unit:** It stores vital reformation such a computer language codes. It has 2 parts:

(1) Random Access Memory

(2) Read Only Memory

(iii) **Arithmetic Logic Unit:** It does all the required calculations.

Q.11. Draw clearly the vertical section of a human tooth, indicating various parts. How are adult human teeth classified?



A Human Tooth
(vertical section)

Fig.

A Human Tooth
(Vertical section)

Classification of Adult Human Teeth:

(1) Upper Jaw (Maxilla) (16 teeth)

(2) Lower Jaw (Mandible) (16 teeth)

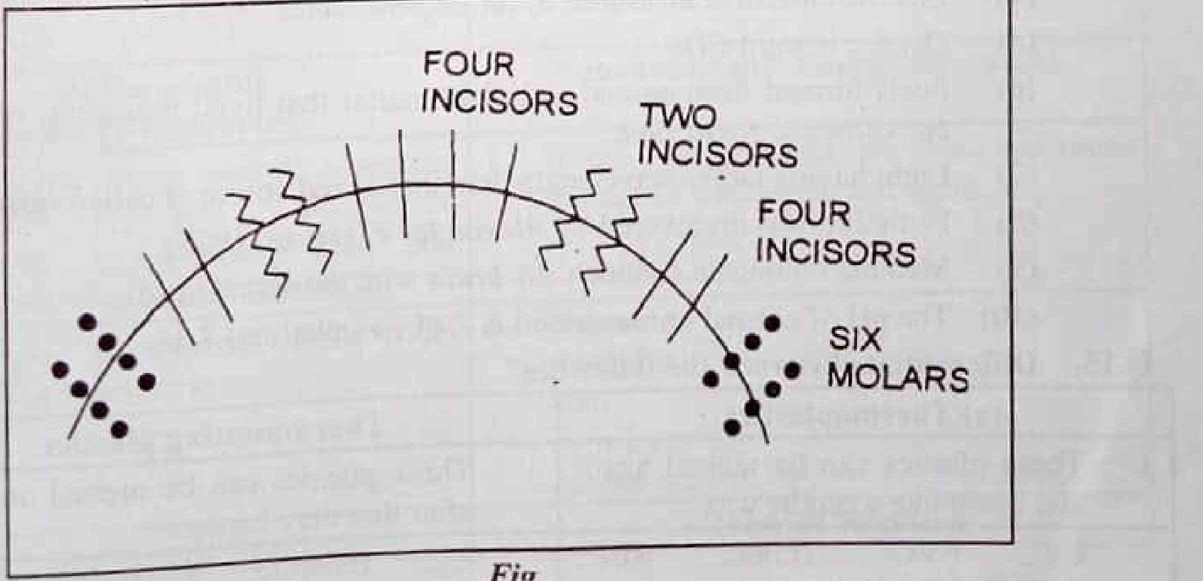


Fig.

Each Jaw has:

4	Incisors
2	Canines
4	Premolars (bicuspids)
6	Molars (tricuspids)

Q.12. Briefly describe the principle and function of a camera? Mention its essential parts alongwith brief comparison with an eye?

Ans. Definition:

It is a device for producing record on sensitive of the image of a person, object or scene formed a lens or mirror system.

Principle and Function of a Camera:

Light that comes from an object is refracted by lens and then is focused as a sharp image n the film. Shutter opens like a small gate to let the light in before closing again. When the shutter opens, a hole is made called aperture through which the light passes. Its size is controlled by a diaphragm. The operator looks through view finder while the view is defined by a range finder. Focusing is carried out by varying the distance of the lens from the film.

(For details, see Ch. 4, portion of Camera)

Q.13. Explain briefly the formation of day and night. How do seasonal variations occur on our Earth?

Ans. Formation of Days and Nights:

(See Ch. 2, Days Nights and Seasons)

Q.14. Fill in the Blanks:

Ans.

(1) **Enzymes** are biological catalysts which have multiple functions in the body.

(2) The difference between electrical changes at the two ends of a conductor is called ***potential difference.***

(3) The branch of zoology which deals with the study of insects is called ***entomology.***

(4) Electric current is measured by an ***ampere*** meter.

(5) Dry ice is solid CO_2.

(6) Fuels formed from animal and plant matter that lived thousands of years ago are known as ***fossil fuel.***

(7) Light having larger wavelength than that of red colour is called ***infra red.***

(8) Penicillin was discovered by ***Alexander Fleming*** (1928)

(9) Medulla oblongata connects the ***brain*** with the spinal cord.

(10) The pH of normal human blood is ***7.45*** → (alkaline) 7.35.

Q.15. Differentiate between the following?

(a) Thermoplastics	**Thermosetting plastics**
1. These plastics can be melted again and again like a candle wax.	1. These plastics can be melted only once, after that they harden.
e.g., PVC, Teflon, ABC, polyethylene, Nylon.	e.g., Bakelite, Melamine, silicone, polyesters, epoxy plastics.

(b) Lunar Eclipse	Solar Eclipse
1. It occurs when the Earth conies between the Moon and the Sun.	1. It occurs when the Moon comes between the Earth and the Sun.
2. When the Earth lies exactly between Moon & Sun and its shadow covers the whole of Moon this is called total eclipse of the Moon. At this time Earth lies in umbral region.	2. The shadow of Moon, which it throws on Earth consist of an umbra and penumbra people on Earth who are in umbral region can't see the Sun. This is total eclipse of the Sun.
3. When the Moon covers out of umbral region of Earth's shadow, it goes through series of partial eclipses.	3. Those in the penumbra can see a part of Sun called as a partial eclipse of the Sun.

(c) Asteroid	Meteorite
1. These are the small rocky objects that are orbiting the Sun between the orbits of Mars and Jupiter, as an asteroid belt (140 million miles)	1. These are the tiny chunk of material floating in the space that can enter the Earth's atmosphere and become a meteor.
2. These are also called as minor planets, although asteroid means "starlike".	2. Meteor is also called as falling star; it is seen as a streek of light in the sky.
3. Its origin is connected to the remains of a planet that fell apart.	3. A burning meteor is called as a shooting star. Most of them burn up before reaching the ground. If they do reach the ground they become meteorites.
4. Ceres asteroid (1801) is the largest asteroid (680 miles)	4. It may originate by the disintegration of a comet or are the left-overs from the birth of a Solar system.
5. Asteroids passing near the Earth are called as Earth crosser/Apollo Asteroid.	5. They may weigh upto 60 tons Earth gets 501- meteors in an hour.

(d) Renewable Energy Resources	Non-Renewable Energy Resources
1. These are those energy resources which replenish themselves naturally in a short time and therefore always be available.	1. These energy which are those resources cannot be used again and again.
2. Example: geothermal, Solar tidal wind hydro-electric	2. Example: fossil fuel coal petroleum natural gas

(e) Endothermic Reaction	Exothermic Reaction

1.	These are those chemical reactions that require heat for their completion.	1.	These are those chemical reactions that liberate heat after the completion.
	(f) Star		**Plant**
1.	It is a self-luminous heavenly body.	1.	It is a rocky non-luminous body.
2.	It twinkles due to line-of-sight effect and disturbance in the gases of the atmosphere around the Earth.	2.	It reflects light of a star/stars.
3.	It forms a centre of Solar system e.g., Sun.	3.	It revolves around the central star in its orbit.
4.	Planets revolve around the star.	4.	Satellites revolve around the planet e.g. Moon.
5.	These are usually regarded as stationary.	5. — —	They possess these’ types of movements: rotation revolution
6.	It is a hot body.	6.	It is a cold body.
7.	Through telescope it is seen as a spot of light.	7.	It is seen as disc.
	(g) Nuclear Fusion		**Nuclear Fission**
1.	It is a process in which lighter atoms are fused together at a very high temperature to produce heavier elements accompanied by a release of large amount of energy.	1.	It is a process in which heavier unstable atoms are broken down to yield energy.
2.	It requires cheaper and abundant elements.	2.	It requires expensive & rare elements.
3.	It is not commercialized as a very high temperature is required to initiate it.	3.	It is commercialized and it is well under control.
4.	It is difficult to do on Earth.	4.	It is easy to do on Earth.
5.	It has no nuclear waste problem.	5.	It has a problem of nuclear waste and radio activity.

EVERYDAY SCIENCE 1997

Q. 1. **Discuss the role and achievements of Muslim physicists during the 10th century:**

Ans. 1. Abdul Qasim Al-Zahrawi: (936 A.D. 1013 A.D.):

Ans. (See Appendices)

2. **Al-Biruni (973 A.D. —1048 A.D.):**

Ans. (See Appendices)

3. **Ibn Al-Haitham (975 A.D. 1039 A.D.):**

Ans. (See Appendices)

4. **Abu Ali Sina (980 A.D. —1037 A.D.):**

Ans. (See Appendices)

Q. 2. **Explain the structure of Earth and its atmosphere?**

Ans. (See Ch. 3, the structure of Earth and Earth's atmosphere)

Q. 3. **Write short notes on any of the following:**

Ans. **Solar Eclipse:** (See Ch. 1, Solar Eclipse)

2. **Non-Renewable Energy Sources:**

Ans. (See Ch. 3, portion of Fossil Fuels)

3. **Natural Gas:**

— **Formation**: As the oil is formed under the bed of the Earth's surface by biodegradation of plants and animals, it also gives off large amount of natural gas.

— Its main constituent is Hydrocarbons.

— **Composition: (unprocessed gas)**

60 – 80%	methane
5 – 9%	ethane
3 – 18%	propane
2 – 14%	higher hydrocarbons

— **Uses:**

1. Used as fuel.
2. Used as raw material for the synthesis of many organic compounds e.g. rubber.
3. Used for production of electricity.
4. Cheapest and the most efficient source of energy in Pakistan.
5. Used in industry for power generation.
6. Used for domestic purposes.

Discovery:

It was discovered in 1952 at Sui (Balochistan) in Pakistan.

Energy Profile for Pakistan

Year	Production of Electricity in Pakistan
1947	Coal 59%, Hydro 3%, Oil 38%
1987	Coal 9%, Hydro 13%, Oil 40%, Gas 48%

3. Thermoplastics: Definition:

“These are those plastics which can be melted again and again much like the wax in a candle”.

Examples:

Polyethylene
Nylons
Acrylic
Polystyrene
PVC
Teflon
ABS
Cellulose nitrate

Uses:

1. PVC plastic is flexible, abrasion resistant, low cost and heat stable thus it is used for producing film and sheet for packing materials.
   Rigid PVC is used in pipe fittings, pump parts and chemical laboratory equipment.
2. Polyethylene is used in making films, transparent sheets, baskets, buckets, hospital disposables, food containers and toys.
3. Polystyrene is used in house-wares, packaging, toys & wall-tiles.
4. Nylon is used in cloth industry.
5. Acrylic is also used in cloth making.
6. Teflon is used in tank, pipe lining, filter media, pump components, artificial ear ossicle.
7. Cellulose is used in place of ivory.

Q. 4. What is the difference between?

Ans.

(i) BIT	**BYTE**
“The main storage” is one of the four major physical components or hardware. “Main storage” was once made up of vacuum tubes and later of magnetic cores. Each tube or core represent one “bit”. It is now made up of tiny integrated circuits. Each such circuit is made up of thousands of semi-conductors. Each semi-conductor represents one “bit”.	In most microcomputers, Byte is a combination of eight bits. Each Byte represents a numeral, 9 letter of the alphabet, 9 punctuation mark, or anything else the computer can show The more bytes a computer can store the more work it can do. A computer memory is measured in bytes. 1. Mega byte = 1,048,576 bytes.
(ii) RAM	**ROM**
“Random Access Memory”.	“Read Only Memory”
It is a type of memory stored in a computer which both can be read from and written to, is erased each time the computer is turned off.	It is a type of memory stored in a computer which can’t be written to, maintains its contents all the times and is used to store the computer’s control information.
(iii) Hardware	**Software**
1. It consists of 4 major physical components of the computer.	1. It consists of computer programme.

1. CPU	It controls the functioning of hardware and directs its operation. It contains
2. Main storage	1. electronic circuits
3. Auxiliary storage	2. chips
4. input/output devices	3. transistors
2. It is a plastic made part of computer.	2. It is a delicate part of computer.
(iv) Personal Computer	**Mainframe Computer**
1. It is one of the 2 types of microcomputer.	1. It is the largest and most powerful general-purpose system which is designed to meet the computing needs of a large organization by serving hundreds of computer terminals at the same time.
— It is powered by a micro processor.	
— It is originally single user computer.	
— Multiple microcomputers can be linked up through.	
1. Local area network. OR	
2. Parallel processing system.	
Now a micro computer can also perform a task once reserved for mainframes.	

Q. 5. Explain any five of the following terms in not more than 4 lines each:

Ans. *(i)* **OSMOSIS:**

"It is the movement of water molecules from the lower solute concentration to the higher solute concentration".

It depends upon:

1. Temperature
2. No. of solute particles

(ii) **Glycolysis:**

"It is a process that can start from glycogen break down (glycogenolysis) or glucose breakdown and both these meet at a stage of glucose -6- phosphate".

During glycolysis 8 moles of ATP are produced due to the conversion of one mole of glucose to 2 mole of pyruvic acid, 2 ATPs are utilized.

6 (ADP + Pi) 6 ATP

$$\text{Glucose} \xrightarrow[\text{Partial Oxidation}]{\substack{6(\text{ADP}) + \text{Pi})\ 6\ \text{ATP} \\ \uparrow}} \text{2 moles of pycuric acid}$$

(iii) **Photosynthesis:**

For "photo synthesis" a plant requires CO_2 + sunlight and chlorophyll. As Earth is rotating around its axis, thus Sun rays doesn't remain in the same direction all the day, therefore plants changes their direction in order to get optional amount of sunlight. This is called photo taxis".

(iv) **Transpiration:**

"It is the loss of water from the plant in the form of water vapours, through stomata"

Formation:

1. Temperature regulation of the environment.
2. Keeps the water content of plant within normal limit.

(v) **Sponification:**

It is a chemical process in which animal fat is made to react with caustic soda to make a soap.

Emulsion:

"If an oil such as corn oil is shaken vigorously with water, it is broken into smaller droplets to form a homogeneous mixture called emulsion".

e.g.
1. Milk (natural stable emulsion of butter fat in water)
2. Sodium stearate soap + water + oil (stable emulsion)

Q. 6. Fill in the blanks:

Ans.
(i) A sheet of muscles called **diaphragm** separates the chest from the abdomen.
(ii) In the human body, **blood clotting** factor is 1 produced by the liver.
(iii) Human blood is able to carry large amounts of oxygen because of the chemical **hemoglobin**.
(iv) The living part of a plant cell is composed of nucleus and **cytoplasm**.
(v) The pattern for building protein molecules stored in the **messenger RNA**.
(vi) Anvil and stirrup are names of bones present in the **ear.**
(vii) The front of the eye is covered with a tough transparent material called **cornea.**
(viii) The young plant inside a grain of wheat is called the plumule.
(ix) **Manometer** is an apparatus used for measuring the pressure of gases.
(x) The smallest branches of an artery lead into tiny blood vessels called **capillaries**

Q. 7. What are exocrine glands? Give names of any four alongwith the name of their secretion?

Ans. Definition:

These are those glands which discharge their secretions by means of a duct. These are also called as ducted glands.

Examples:

	Exocrine Gland	Secretion
1.	Lachrymal gland	Tears
2.	Sweat gland	Sweat
3.	Salivary	Saliva
4.	Sebaceous gland	Sebum

Q.8. Which quantity do the following units measure?

Ans.

	UNIT	QUANTITY
1.	Volt	Voltage/Potential

2.	Coulomb	Charge of electricity
3.	Watt	Power
4.	Ohm	Resistance
5.	Mho	Conductivity
6.	Ampere	Current
7.	Dyne	Force
8.	Celsius	Temperature
9.	Joule	Energy
10.	Calorie	Heat

Q. 9. Give scientific reasons in not more than 4 lines each for the following:

Ans.

(i) **Meat takes longer to cook on the mountains:**

The atmospheric pressure decrease as the altitude increases. The boiling point of water is 100°C at standard atmospheric pressure, At the mountains this atmospheric pressure is less, thus water boils at temperature lower than 100°C. Therefore, meat takes longer time to be cooked. This can be overcome by using pressure cookers.

(ii) **Water remains cool in earthen pitchers:**

As perspiration lowers down the body temperature due to continuous evaporation from skin, similarly the pores of pitcher act as sweat glands and evaporation of water through them cools down the water.

(iii) **Ice & salt mixture is used as a freezing agent in manual ice cream makers.**

Addition of salt in the ice lowers its freezing point and makes a cheap freezing mixture for manual ice cream makers.

(iv) **It is not advisable to sleep under trees during the night:**

During the night plants don't carry on photosynthesis i.e., they don't release O_2, and only respiration is there which releases CO_2. Thus it is not advisable to sleep under trees in order to avoid excessive CO_2 concentration in air.

(v) **Green house operators paint their glass roofs white in summer.**

In summer there is already much hot and white colour has a property of reflection of light to a maximum extent as compared to other colours. Thus green house operators paint their glass roofs white, in order to avoid over heating in their green houses.

Q.10. Which part/organ of the human body do the following belong?

Ans.

	Item	**Part/Organ**
1.	Eustachian Tube	Ear
2.	Cartilage	Connective Tissue
3.	Auricle	Heart
4.	Tendon	Muscle
5.	Dendrites	Neuron (nerve cell)

Q. 11. Fill in the blanks with correct choice: Ans.

Ans.

(i) Insulin is produced in the human body by the **pancreas.**

(ii) In an animal cell protein is synthesised in the **ribosome.**

(iii) Chemically finger nails are made up of **protein.**

(iv) Muscle stiffness is a symptom caused by the disease **tetanus.**

(v) Animals which obtain their food from dead organisms are called **scavengers.**

(vi) Vitamin C is not affected by cooking **(vitamin C,** Thiamin, Riboflavin)

(vii) Rickets is caused by the deficiency of vitamin D.

(viii) A number of chromosomes in a spermatozoa is **23.**

(ix) The tat in our food is digested by the *enzyme* **lipase.**

(x) The most abundant element in the human body is **carbon.** (C, H, O)

Q.12. Which of the following statement are false and which are true?

Ans.

(i) Sound is a form of energy. (True)

(ii) A fraction of sunlight is **refracted as** it enters the Earth's atmosphere. (True)

(iii) The energy possessed by a water fall is kinetic energy. (True)

(iv) Rainbow are produced by the reflection of light through rain drops. (True)

(v) Light switches in our homes are connected in parallel series. (True)

(vi) Generators convert mechanical energy into electricity. (True)

(vii) Modern incandescent bulbs contain filaments made of Cu. (False)

(viii) A steam engine can't be powered by fossil fuel. (True)

(ix) Nuclear energy is a cheap source of abundant electricity. (True)

(x) Oil burns cleaner and is less damaging to the environment than coal as a fuel. (True)

Q.13. Match words of list A with those of list B.

Ans.

	List A	List B
1.	Protein	Amino Acid
2.	Magnesium	Chlorophyll
3.	Carotene	Vitamin A
4.	Bauxite	Al
5.	Haemitite	Fe
6.	Casein	Milk
7.	Pancreas	Fats
8.	Quartz	Si
9.	CFC	Ozone
10.	Urea	Nitrogen

Q.14. Briefly describe the Solar system. Name its members. Out line the main characteristics of any 2 members?

Ans. (See Ch. 1, portion of Solar System)

EVERYDAY SCIENCE 1998

Note: Attempt TEN questions. All questions carry equal marks.

Q. 1. "Earthquakes have helped a great deal in deciphering the internal structure of the Earth". Comment on this statement.

Ans. Please see chapter 1, portion of Earthquake.

Q. 2. Discuss briefly the achievements of Muslims in the development of science. State the reasons of downfall of science in Muslim Society.

Ans. See Chapter 1.

Reasons of downfall of Muslim Society

(i) With the passage of time, Muslim Society became lazy in all aspects of life.
(ii) They became more materialistic.
(iii) Devoid of Islamic teachings.
(iv) Lack of education.

Q. 3. Discuss in detail the fission and fusion processes. Which one of thee processes in the source of solar energy?

Ans. See fission reaction Chapter 1.

Q. 4. Give a detailed description of global warming and its possible effects on life. What measures have been taken by various nations to tackle this problem?

Ans. See Chapter 3, portion of Global Warming.

Q. 5. Give chemical name of one Nitrogenous and one Phosphorus containing fertilizer. What is the role of Nitrogen, Phosphorous and Potash in the growth and development of various parts of a plant?

Ans. See fertilizers, Chapter 3)

Phosphorus containing fertilizer- calcium superphosphate

Nitrogen containing fertilizer- ammonium sulfate

Q. 6. Write short notes on the following:

(i) **Conductor:** Those materials which allow the electricity to pass through them easily without much resistance are called conductors. Most metals like copper, aluminum, iron, silver, gold and their alloys are conductors.

(ii) **Resistor:** A resistor is a two-terminal electronic component that produces a voltage across its terminals that is proportional to the electric current through it in accordance with Ohm's law:

$$V = RI$$

(iii) **Semi-conductor:** "Semi-conductor is a material, may be an element or a compound that conducts electrical current less easily than does a metal such as copper or aluminum but much better than an insulator such as glass or wood. Most metals have quite high conductivity, while substances like diamond and mica have very low conductivity, due to high resistance. Between these extremes lie the semi-conductors. Typical examples are silicon carbide. The resistivities of the semi-conductors range in between 10^{-1} to 10^{9} Ohms/cm. Slight impurities (in traces) in the crystalline structure impart characteristic properties to semi-conductors the semi-conductor is designated n-type or p-type depending on the electrical nature of the holes or energy deficits in the crystalline lattice.

(iv) **Thermistor:** A **thermistor** is a type of resistor whose resistance varies significantly with temperature. The word is a portmanteau of thermal and resistor. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting overcurrent protectors, and self-regulating heating elements.

(v) **Transistor:** A **transistor** is a semiconductor device used to amplify and switch electronic signals. It is made of a solid piece of semiconductor material, with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current flowing through another pair of terminals.

Q. 7. Write short notes on five of the following:

(i) Antibody	(ii) Blood group
(iii) Carbon cycle	(iv) Nitrogen cycle
(v) Scavenger	(vi) Reaction time
(vii) Photosynthesis	(viii) Starfish

Q. 8. Which of the following statements are true?

(i) Trout is a sea fish_________ **(False)**

(ii) Epiphytes is a plant that grows upon another plant. ____ **(True)**

(iii) Hepatitis is inflammation of membranes surrounding the brain. ___ **(False)**

(iv) Meningitis is the inflammation of liver. _____ **(False)**

(v) Equinox is the time when the sun appears vertically overhead at noon at the equator. _________ **(True)**

(vi) Drought is a long period of rain. ________ **(False)**

(vii) Joseph Aspdin is the inventor of cement. ______ **(True)**

(viii) Neurology is the science of nervous system. ______ **(True)**

(ix) Biochemistry is the application of statistics in the study of Biology. ____ **(True)**

(x) Aviculture is the science of the rearing of animals. _______ **(False)**

Q. 9. Name the quantities which are measured by the following units.

(i) Newton	(i) Force
(ii) Joule	(ii) Work Energy
(iii) Watt	(iii) Power of electricity
(iv) Volt	(iv) Potential difference
(v) Light year	(v) Distance of stars and planets
(vi) Angstrom	(vi) Length
(vii) Acre-foot	(vii) Volume
(viii) Becquerel	(viii) Radioactivity
(ix) Hertz	(ix) Frequency
(x) Cusec	(x) Rate of flow of water

Q. 10. Match the cause of the disease:

Answer

S. No.	Disease	Cause
1.	Rickets	Deficiency of vitamin D
2.	Goiter	Iodine deficiency in diet
3.	Typhoid	Salmonella typhosa
4.	Merismis	Protein deficiency
5.	Malaria	Plasmodium

Q. 11. What is the function of each of the following in a motor car?

(i) **Gear box:** it alters the speed of vehicle

(ii) **Battery:** provides electric spark to start the machine/engine

(iii) **Carburetor:** mixes the fuel with air

(iv) **Dynamo:** converts mechanical energy to electrical energy

(v) **Radiator:** cools the engine of a car

Q. 12. Explain the following:

(i) Blood group

A blood type (also called a blood group) is a classification of blood based on the presence or absence of inherited antigenic substances on the surface of red blood cells (RBCs) These antigens may be proteins, carbohydrates, glycoproteins or glycolipids, depending on the blood group system, and some of these antigens are also present on the surface of other types of cells of various tissues. Several of these red blood cell surface antigens that stem from one allele (or very closely linked genes), collectively form a blood group system.

(ii) Short circuit:

(1) An electrical circuit of lower than usual resistance, especially one formed unintentionally.

(2) A short circuit (sometimes abbreviated to short or s/c) allows a charge to flow along a different path from the one intended. The electrical opposite of a short circuit is an open circuit, which is infinite resistance between two nodes. It is common to misuse "short circuit" to describe any electrical malfunction, regardless of the actual problem.

(iii) Short sight:

The inability to see things clearly unless they are relatively close to the eyes; myopia.

Detail: Short-sightedness, is a refractive defect of the eye in which collimated light produces image focus in front of the retina when accommodation is relaxed.

(iv) International date line:

Longitude line located at 180 degrees, longitude line that divides time zones so that one side is one calendar day and the other side is on the next calendar day

(v) Plaster of Paris:

Plaster of Paris, or simply plaster, is a type of building material based on calcium sulfate hemihydrate, nominally $CaSO_4.5H_2O$. It is created by heating gypsum to about 150°C.

Q. 13. Answer the following:

(i) Of what lead pencils are made of?

Ans. Lead pencils are made of graphite and or lead.

(ii) Why is one's breath visible in cold but not in hot weather?

Ans. Due to the differences in the temperatures inside and outside of the body, the water droplets present in the breath condense sharply when we breathe out.

(iii) What is the chemical composition of diamond?

Ans. Diamond is made of a single element called carbon.

(iv) Name the vaccine that protects against tuberculosis.

Ans. BCG

(v) Name the disease of the liver that causes a patient to turn yellow.

Ans. Jaundice

Q. 14. Fill in the blanks.

(i) **Black hole** is a hypothetical region of space having a gravitational pull so great that no matter or radiation can escape from it.

(ii) **Fungicides** are used against mould and fungi.

(iii) The science which deals with heredity is known as **genetics.**

(iv) Insulin is used for the treatment of **diabetes.**

(v) **Yuri Gagarin** is the first space man.

(vi) **Pluto** is the farthest planet from the sun in Solar System.

(vii) The distance between the Earth and the sun is called **Astronomical Unit.**

(viii) The study of chemical processes of living organisms is called **biochemistry.**

(ix) The first computer virus invented by two Pakistani brothers is called the **brain.**

(x) Severe efficiency of vitamin C results in **scurvy.**

Q. 15. Differentiate between any five of the following:

(i) Artery and vein:

Artery: Muscular blood vessels that carry blood away from the heart. All arteries, with the exception of the pulmonary and umbilical arteries, carry oxygenated blood.

Vein: A blood vessel that carries blood toward the heart. The majority of veins in the body carry low-oxygen blood from the tissues back to the heart; the exceptions being the pulmonary and umbilical veins which both carry oxygenated blood.

(ii) Hard water and soft water:

Hard Water: Water that has a high mineral content (contrast with soft water), usually consisting of calcium (Ca2+) and magnesium (Mg2+) ions, and possibly including other dissolved metals, bicarbonates, and sulfates. Calcium usually enters the water as either calcium carbonate ($CaCO_3$) in the form of limestone and chalk, or calcium sulfate ($CaSO_4$) in the form of other mineral deposits.

Soft Water: The term used to describe types of water that contains few or no calcium or magnesium ions. The term is usually relative to hard water, which does contain significant amounts of such ions.

(iii) E-mail and Snail mail:

E-Mail: Method of correspondence via the Internet; communication sent by electronic mail.

Snail Mail: Regular mail, normal postal service (not electronic mail)

(iv) Apes and monkey:

A monkey is any member of either the New World monkeys or Old World monkeys, two of the three groupings of simian primates, the third group being the apes.

(v) **Hydrostatics and hydrodynamics:**

Hydrostatics: Fluid statics (also called hydrostatics) is the science of fluids at rest, and is a sub-field within fluid mechanics

Hydrodynamics: The branch of science concerned with forces acting on or exerted by fluids (especially liquids)

(vi) **Comet and meteor:**

Comet: Any icy object that exists within the solar system. They are pieces of the primitive, unprocessed matter that formed the solar system 4.6×10^9 years ago. They are typically a few kilometers across and consist mainly of dust grains, frozen water, carbon monoxide and carbon dioxide; they contain many simple organic molecules.

Meteor: A meteoroid is a small sand to boulder-sized particle of debris in the Solar system. The visible path of a meteoroid that enters Earth's (or another body's) atmosphere is a meteor, commonly called a "shooting star" or "falling star". Many meteors are part of a meteor shower.

(vii) **Barrage and dam:**

Barrage: Not built at heights. Pressure is not enough to produce electricity. Only Canals are marked out of it.

Dam: Built at heights. Pressure is enough to move turbines so hydroelectricity is generated.

(viii) **Electron and hole:**

Electron: They belong to the lepton family and are the negatively charged components of atoms (1.6×10^{-19} coulomb) In the simplest model of the atom, electrons are envisaged to move around the atomic nucleus in specified circular and elliptical orbits.

Electron Hole: An electron hole is the conceptual and mathematical opposite of an electron, useful in the study of physics and chemistry. The concept describes the lack of an electron. It is different from the positron, which is the antimatter duplicate of the electron.

(ix) **Isobars and isotopes:**

Isobars: line on a weather map or chart that connects areas of equal barometric pressure.

Isotopes: Any of the several different forms of an element each having different atomic mass (mass number) Isotopes of an element have nuclei with the same number of protons (the same atomic number) but different numbers of neutrons.

(x) **Autopsy and biopsy:**

Autopsy: Postmortem, examination of a corpse to determine cause of death.

Biopsy: Removal and study of a tissue sample for diagnostic purposes.

EVERYDAY SCIENCE 1999

Note: **Attempt TEN questions. All questions carry equal marks.**

Q. 1. **Discuss in brief, the contribution of Muslim scientists in the field of biological science.**

Ans. See Chapter 1.

Q. 2. **Describe, in precise statements, various instruments which are being used in exploring the Universe.**

Ans. The Universe can be explored by astronomical instruments called telescopes, and by space probes sent from Earth to other planets. When using telescopes astronomers try to look at the energy being produced by the Universe not just in the visible part of the spectrum (where our eyes can see) but at the whole range of electromagnetic radiation. We thus have radio telescopes, infrared telescopes, X-ray telescopes and even some telescopes that are buried deep underground looking for neutrinos.

Various Instruments

The most notable Universe exploring instruments may be as follows

(a) **The Hubble Space Telescope (HST)**: The Hubble Space Telescope (HST) is a telescope in orbit around the Earth, named after astronomer Edwin Hubble. Its position outside the Earth's atmosphere provides significant advantages over ground-based telescopes — images are not blurred by the atmosphere, there is no background from light scattered by the air, and the Hubble can observe ultra-violet light that is normally absorbed by the ozone layer in observations made from Earth.. Since its launch in 1990, it has become one of the most important instruments in the history of astronomy. With it, astronomers have made many observations leading to breakthroughs in astrophysics. Hubble's Ultra Deep Field is the most sensitive astronomical optical image ever taken.

(b) **Wilkinson Microwave Anisotropy Probe (WMAP)**: The Wilkinson Microwave Anisotropy Probe (WMAP) is a NASA satellite mission led by Professor Charles L. Bennett of Johns Hopkins University, whose mission is to survey the sky to measure the temperature of the radiant heat left over from the Big Bang. The satellite was launched by a Delta II rocket on June 30, 2001, at 3:46 p.m. EDT from Cape Canaveral Air Force Station, Florida, USA.

Q. 3. **Explain the Solar System and the unifying characteristics which the Sun and its planets have.**

Ans. See chapter 2, Portion of Solar System)

Q. 4. **How the solar and lunar eclipses are caused?**

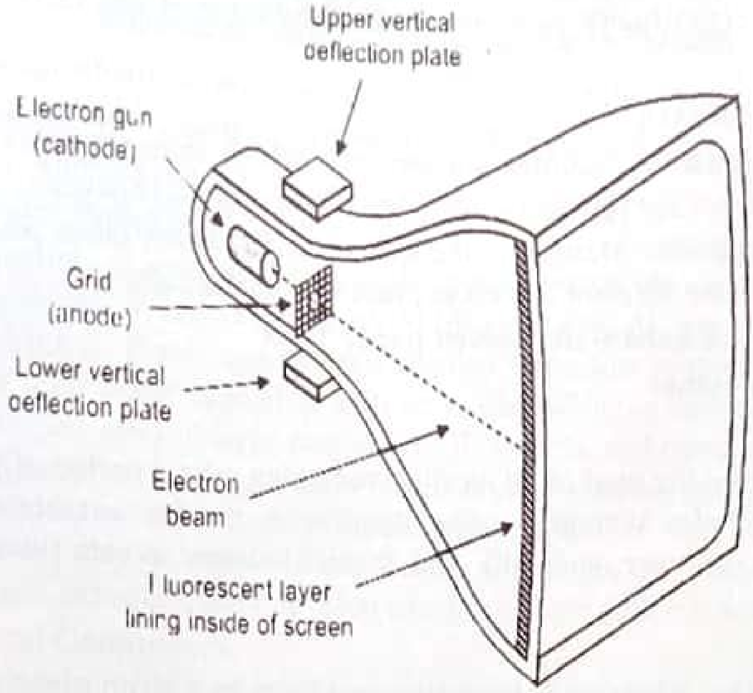
Ans. See chapter 2, Portion of Eclipses.

Q. 5. **What is Ozonosphere? Discuss the human technologies which are causing its depletion. What harm to man this depletive state would cause?**

Ans. **Ozonosphere**: A layer in the stratosphere (at approximately 20 miles) that contains a concentration of ozone sufficient to block most ultraviolet radiation from the Sun for further details see chapter 2, portion of ozone depletion.

Q. 6. **Describe the principle and make up of a Television.**

Ans. See Chapter 1, Television.


Upper vertical deflection plate
Electron gun (cathode)
Grid (anode)
Lower vertical deflection plate
Electron beam
Fluorescent layer lining inside of screen

Cross-sectional representation of a cathode ray tube

Q. 7. **What is escape velocity? How the Satellites are launched and what are their uses?**

Ans. **Escape Velocity:** See chapter 1.

Q. 8. **Explain Earthquakes and volcanoes. How volcanoes help in the formation of Earth crust?**

Ans. See Earthquakes Ch 1, see volcanoes Ch. 1.

Q. 9. **How characters are transmitted from parents to offspring?**

Ans. Characteristics are transferred from parents to their offsprings through genetic material called DNA. All the informations are stored in the small fragments of DNA called genes. Genes are the structural and functional units of hereditary. The transfer of characteristics from parents to offsprings is called hereditary. The characteristics are transmitted from parents to offsprings through genes. The genes which show their characteristics are said to be switched-on while the genes which do not express themselves are said to be switched-off.

Q. 10. **Describe the function of kidneys in the human body.**

Ans. See chapter 2, Portion Kidneys.

Q. 11. **What are the deficiency effects of the following nutrients in the human body?**

(a)	**Iron**	Anemia
(b)	**Iodine**	Goiter
(c)	**Fluoride**	May cause increased dentall caries and possibly osteoporosis
(d)	**Vitamin A**	Its deficiency also causes retarded growth, Night blindness and susceptibility to infection.
(e)	**Vitamin D**	Rickets

Q. 12. What are the constituents of human blood and their characteristics?

Ans. See chapter 2.

Q. 13. Differentiate between

(a) **Neuron and neutron:** Neurons are the cells which transmit nerve impulse in the body. Neutrons are the subatomic particles which carry no charge.

(b) **Meiosis and mitosis:** Meiosis is the cell division which takes place in sex cells, while mitosis is the division that takes place in somatic cells.

(c) **Heavy water and hard water solved paper 1998**

(d) **Climate and weather**

Climate:

Climate describes the total of all weather occurring over a period of years in a given place. This includes average weather conditions, regular weather sequences (like winter, spring, summer, and fall), and special weather events (like tornadoes and floods)

Weather:

Weather describes whatever is happening outdoors in a given place at a given time. Weather is what happens from minute to minute. The weather can change a lot within a very short time.

(e) **Isotopes and isobars (solved paper 1998)**

Q. 14. Fill in the blanks

(a) Plant cells manufacture their food due to the presence of ____________ (*chlorophyll*, vacuole, cell wall)

(b) The mitochondria in a cell are the constituent of the ____________ (nucleus, *cytoplasm*, cell membrane)

(c) Mitosis is a type of cell division wherein the number of chromosomes in the daughter cell is the ____________ (*same*, half, double)

(d) Blood cells are of ____________ types (two, *three*, four)

Platelet is actually a fragment of the large bone marrow cells known as megakaryocytes

(e) The ____________ causes sunburn and suntan (**ultraviolet rays**, alpha particles, gama radiation)

Q. 15. Which of the following statements are false or true. Write only true of false in the answer book. Do not reproduce the questions.

(a) Xylem and Phloem are conducting tissues. **(True)**

(b) Carbohydrates are cheapest and most ready source of energy. **(True)**

(c) Enzymes are responsible for chemical digestion of food. **(True)**

(d) Plasma is the fluid part of the blood in which the cells are suspended. **(True)**

(e) Hemoglobin combines with oxygen and transport to different cells of the body. **(True)**

(f) Neutron is the negative charged particles in an atom. **(False)**

(g) Helium is the lightest gas. **(False)**

(h) Venus is the smallest planet of the solar system. **(False)**

(i) Image of an object is formed on the retina of the eye. **(True)**

(j) Barometer is used for measuring the current. **(False)**

EVERYDAY SCIENCE 2000

Q. 1. Write comprehensive notes on any TWO of the following:

(a) Contribution of Muslim scientists in the field of Biology

Ans. (a) See Appendices.

(b) Water Pollution:

Contamination of streams, lakes, underground water, bays, or oceans by substances harmful to living things. Water is necessary to life on Earth. All organisms contain it; some live in it; some drink it. Plants and animals require water that is moderately pure, and they cannot survive if their water is loaded with toxic chemicals or harmful microorganisms. If severe, water pollution can kill large numbers of fish, birds, and other animals, in some cases killing all members of a species in an affected area. Pollution makes streams, lakes, and coastal waters unpleasant to look at, to smell, and to swim in. Fish and shellfish harvested from polluted waters may be unsafe to eat. People who ingest polluted water can become ill, and, with prolonged exposure, may develop cancers or bear children with birth defects.

(c) Semi Conductors

Ans. See Ch. 1, portion of Semi-conductors.

Q. 2: Describe various types of movements of the Earth. What are the effects of these movements?

Ans. See day night and seasons, Ch. 1.

Q. 3: Explain the following with suitable examples.

(a) Feed-back mechanism of human system

Positive feedback

Positive feedback mechanisms are designed to accelerate or enhance the output created by a stimulus that has already been activated.

Unlike negative feedback mechanisms that initiate to maintain or regulate physiological functions within a set and narrow range, the positive feedback mechanisms are designed to push levels out of normal ranges. To achieve this purpose, a series of events initiates a cascading process that builds to increase the effect of the stimulus. This process can be beneficial but is rarely used by the body due to risks of the acceleration's becoming uncontrollable.

One positive feedback example event in the body is blood platelet accumulation, which, in turn, causes blood clotting in response to a break or tear in the lining of blood vessels. Another example is the release of oxytocin to intensify the contractions that take place during childbirth.

Negative feedback

Negative feedback mechanisms consist of reducing the output or activity of any organ or system back to its normal range of functioning. A good example of this is regulating blood pressure. Blood vessels can sense resistance of blood flow against the walls when blood pressure increases. The blood vessels act as the receptors and they relay this message to the brain. The brain then sends a message to the heart and blood vessels, both of which are the effectors. The heart rate would decrease as the blood vessels increase in diameter (or vasodilation). This change would cause the blood pressure to fall back to its normal range. The opposite would happen when blood pressure decreases, and would cause vasoconstriction.

(b) Eco-System

Ecosystem: (See solved paper 1994)

(c) Troposphere:

Troposphere, lowest layer of the Earth's atmosphere and site of all weather on the Earth. The troposphere is bounded on the top by a layer of air called the tropopause, which separates the troposphere from the stratosphere, and on the bottom by the surface of the Earth. The troposphere is wider at the Equator (16 km/10 mile than at the poles (8 km/5 mile. The temperature of the troposphere is warmest in the tropical (latitude 0° to about 30° north and south) and subtropical (latitude about 30° to about 40° north and south) climatic zones (See climate) and coldest at the polar climatic zones (latitude about 70° to 90° north and south) Observations from weather balloons have shown that temperature decreases with height at an average of 6.5°C per 1000 m (3.6°F per 1000 ft), reaching about −80°C (about −110°F) above the tropical regions and about −50°C (about −60° F) above the polar regions.

(d) Carbon Cycle:

Carbon Cycle (ecology), in ecology, the cycle of carbon usage by which energy flows through the Earth's ecosystem. The basic cycle begins when photosynthesizing plants use carbon dioxide (CO_2) found in the atmosphere or dissolved in water. Some of this carbon is incorporated in plant tissue as carbohydrates, fats, and protein; the rest is returned to the atmosphere or water primarily by aerobic respiration. Carbon is thus passed on to herbivores that eat the plants and thereby use, rearrange, and degrade the carbon compounds. Much of it is given off as CO_2, primarily as a by-product of aerobic respiration, but some is stored in animal tissue and is passed on to carnivores feeding on the herbivores. Ultimately, all the carbon compounds are broken down by decomposition, and the carbon is released as CO_2 to be used again by plants.

(e) Meningitis:

Meningitis, inflammation of the meanings, the membranes that surround the brain and spinal cord. Meningitis may be caused by a physical injury, a reaction to certain drugs, or more commonly, infection by certain viruses, bacteria, fungi, or parasites.

Cause:

The most common causes of viral meningitis are coxsackie viruses and echoviruses, although herpesviruses, the mumps virus, and many other viruses can also cause the disease. Viral meningitis is rarely fatal, and most patients recover from the disease completely.

Q. 4: What is excretion? Name excretory organs in the man. Describe the structure and function of human kidney.

Excretion:

Water and water-soluble substances travel via the bloodstream from the intestines to the kidneys, which absorb all the constituents of the blood plasma except its proteins. The kidneys return most of the water and salts to the body, while excreting other salts and waste products, along with excess water, as urine.

For details see chapter 2, The Kidney.

Q. 5: Describe the principle, construction and working of telephone.

Ans. See Ch. 4, Telephone.

Q. 6: **What are latitudes and longitudes? How can the central line of latitude and longitude be used to find the location of a place?**

Ans. See Ch. 1, portion of Map Reading.

Q. 7: **Differentiate between:**

(a) Cardiac Muscles and Skeletal Muscles:

Skeletal Muscle Skeletal muscle enables the voluntary movement of bones. Skeletal muscle consists of densely packed groups of elongated cells known as muscle fibers.

This type of muscle is composed of long fibers surrounded by a membranous sheath, the sarcolemma.

Cardiac muscle, found only in the heart, drives blood through the circulatory system.

(b) Haze and Smog:

Haze:

Particles in atmosphere: mist, cloud, or smoke suspended in the atmosphere and obscuring or obstructing the view.

Smog:

Smog, mixture of solid and liquid fog and smoke particles formed when humidity is high and the air so calm that smoke and fumes accumulate near their source.

Enzyme and Hormone:

Enzyme:

Enzymes are the biological catalysts which speed up the chemical reactions taking place in our body. Examples are trypsin, amylases etc.

Hormone:

Hormone, chemical that transfers information and instructions between cells in animals and plants. Often described as the body's chemical messengers, hormones regulate growth and development, control the function of various tissues, support reproductive functions, and regulate metabolism (the process used to break down food to create energy).

(d) Sedimentary Rock and Igneous rock:

Sedimentary Rock, in geology, rock composed of geologically reworked materials, formed by the accumulation and consolidation of mineral and particulate matter deposited by the action of water or, less frequently, wind or glacial ice.

Igneous Rock:

Igneous Rock, rock formed when molten or partially molten material, called magma, cools and solidifies. Igneous rocks are one of the three main types of rocks; the other types are sedimentary rocks and metamorphic rocks. Of the three types of rocks, only igneous rocks are formed from melted material.

(e) Producers and consumers:

Plants are primary producers. All life in an ecosystem depends on primary producers to capture energy from the Sun, convert it to food that is stored in plant cells, and pass this energy on to organisms that eat plants.

Consumers:

Primary consumers are animals that feed on plants. This group includes some insects, seed and fruit-eating birds, rodents, and larger animals that graze on vegetation, such as deer. When primary consumers eat primary producers (plants), the energy in plant cells changes into a form that can be stored in animal cells.

Q. 8: Define the following terms:

(i) RAM
(ii) Byte
(iii) Icon
(iv) Mouse
(v) Software
(vi) Control unit
(vii) LAN
(viii) Modem
(ix) ALU
(x) Registers

Ans. See the portion and exercise of computers, Chapter 4.

Q. 9: Discuss the structure of a typical animal cell in detail.

Ans. See Ch. 2, portion of cell.

Q. 10: Fill in the blanks:

(i) Monomers of proteins are _____ **(amino acids)**
(ii) Water transport in plants occurs via _______ **(xylem)**
(iii) Underground horizontal stems are called _____ **(rhizome)**
(iv) In the eye, only ______ contain receptors for light energy. **(rods)**
(v) Plant _____ control plant responses to environmental stimuli. **(hormones)**
(vi) ________ are often called power house of cells. **(mitochondria)**
(vii) The rate at which current changes its direction is called its ________ **(frequency)**.
(viii) The energy of electrons at the negative terminal of battery is called ________ **(chemical energy)**
(ix) ______ is the smallest planet in solar system. **(Pluto)**
(x) Diamond is an allotropic form of element _____ **(carbon)**

Q. 11: What are plastics? Name their different types and processes by which they are manufactured?

Ans. See the portion of plastics, Ch. 1.

Q. 14: What are the causes of Earthquakes? How are the Earthquakes helped in deciphering the internal structure of Earth?

Ans. See Ch. 2, portion of Earthquakes.

Q. 15: What is endocrine system? Write the names and functions of endocrine glands.

Ans. See the portion of Hormone and Endocrine glands, Ch. 2.

EVERYDAY SCIENCE 2001

Time Allowed: 3 Hours **Maximum Marks: 100**

Note: **Attempt any ten questions. All questions carry equal marks.**

Q. 1. (a) **What were the special characteristics of Muslim Scientists?**

(b) **What were the contributions of the following Muslim Scientists?**

(i) **Umar Al-Khayyam.** (ii) **Abu Ali Sina**

(iii) **Ibn Hayyan** (iv) **John al Baitar**

(v) **Zakariya Al-Razi.**

Ans. See Appendices.

Q. 2. (a) **Differentiate clearly between Cyclone, Huriicane and tornado.**

Ans. See exercise of chapter 1.

(b) (i) **Name two minerals which are exported from Pakistan.**

Ans. Gypsum and Common salt.

(ii) **Name some gem-minerals used in Jewellery.**

Ans. Topaz, Emerald, Jade, Opel, Saphire, Garnet, Diamond etc.

(iii) **What is Dead Sea?**

Ans. Dead Sea contains very high salt concentrations. Its density is very high as compared with normal sea-water due to very high salt concentrations and dissolved materials. No life exists in Dead Sea because organisms cannot grow and reproduce in it due to high a salt content that is why it is called Dead Sea.

(iv) **Why does the Sun appears orange-red at the time of Sunrise and Sunset?**

The Earth's dust, gas and air particles scatter the Sun's light in different directions. Violet light has a peculiar property due to which it gets scattered the most. Red light gets scattered the least.

At Sunrise the Earth is rotating towards the Sun. Similarly, during sunset, the Earth is rotating away from the Sun. During these times the sunlight has to travel at an angle and thus cover a longer distance through the atmosphere. It encounters more obstacles in its path. Most of the colours, like green and violet, get scattered before the light reaches the Earth. Since red is scattered the least, it is this colour that we see as it reaches us.

(v) **Why does the total Eclipse can happen only at the new Moon?**

Ans. See exercise of Ch. 1.

Q. 3. (a) **Name popular forms of Energy. Write five various scientific devices used to convert one type of energy into another form of energy.**

Ans. Electrical energy, thermal energy, hydel energy, solar energy, geothermal energy.

ENERGY CONVERSION:

Transducer, device that converts an input energy into output energy.

Electric Motors and Generators, group of devices used to convert mechanical energy into electrical energy, or electrical energy into mechanical energy.

Photosynthesis, process by which green plants and certain other organisms use the energy of light to convert carbon dioxide and water into the simple sugar glucose.

Turbine, rotary engine that converts the energy of a moving stream of water, steam, or gas into mechanical energy.

Wind Energy, energy contained in the force of the winds blowing across the Earth's surface, is converted into electrical energy by wind mills.

(b) Write meaning of the following units:

(i) Barrel **(ii) Joule**
(iii) Btu **(iv) KWh**
(v) Newton.

Ans. See Ch 3, portion of energy terms and commonly used scientific units

Q. 4. Write short notes on any THREE of the following:

(i) Synthetic Polymers:

Ans. See plastics, Ch. 1.

(ii) Laser:

Ans. See solved paper 1996

(iii) Pesticides:

Ans. See portion of pesticides, Ch. 1.

(iv) Fission and Fusion:

Ans. See solved paper 1998

(v) Paramagnetism, Diamagnetism

Paramagnetism:

Ans. Is a form of magnetism that occurs only in the presence of an externally applied magnetic field. Paramagnetic materials are attracted to magnetic fields and hence have a relative magnetic permeability of ≥1 (a positive magnetic susceptibility)

Diamagnetism is the property of an object which causes it to create a magnetic field in opposition to an externally applied magnetic field, thus causing a repulsive effect.

Q. 5. Write difference between:

(i) Microcomputer and Minicomputer

Ans. Minicomputer, a mid-level computer built to perform complex computations while dealing efficiently with a high level of input and output from users connected via terminals.

Microcomputer, desktop or notebook-size computing device that uses a microprocessor as its central processing unit, or CPU (See Computer).

(ii) Main frame and Super computer:

Supercomputer, computer designed to perform calculations as fast as current technology allows and used to solve extremely complex problems.

(iii) Hardware and Software:

(iv) Byte and Word:

(v) Ram and Cache memory:

Ans. See the portion of computers and exercise Chapter 5.

Q. 6. Describe briefly the principle and working of any TWO of the following:

(i) **Pressure Cooker:**

Ans. Pressure cooker is a device which is used to cook food in lesser time. In pressure cooker, high pressure is applied in the form of hot steam. Hot and pressurized steam has greater penetrating capacity than boiling water because it contains more energy. So, this energy has the ability to cook food in lesser time.

(ii) **Television:**

Ans. See television Ch. 5.

(iii) **Microwave oven**

Ans.

Microwave Oven, appliance that uses electromagnetic energy to heat and cook foods. A microwave oven uses microwaves, very short radio waves commonly employed in radar and satellite communications. When concentrated within a small space, these waves efficiently heat water and other substances within foods.

In a microwave oven, an electronic vacuum tube known as a magnetron produces an oscillating beam of microwaves. Before passing into the cooking space, the microwaves are sent through a fanlike set of spinning metal blades called a stirrer. The stirrer scatters the microwaves, dispersing them evenly within the oven, where they are absorbed by the food. Within the food the microwaves orient molecules, particularly water molecules, in a specific direction. The oscillating effect produced by the magnetron changes the orientation of the microwaves millions of times per second. The water molecules begin to vibrate as they undergo equally rapid changes in direction. This vibration produces heat, which in turn cooks the food.

(iv) Radar (See Radar Ch. 1)

(v) Tape recorder. In analog tape recording, electrical signals from a microphone are transformed into magnetic signals. These signals are encoded onto a thin plastic ribbon of recording tape. Recording tape is coated with tiny magnetic particles. Chromium dioxide and ferric oxide are two magnetic materials commonly used. A chemical binder coats the particles to the tape, and a back coating prevents the magnetic charge from traveling from one layer of tape to the next.

Q. 7. **Differentiate between:**

(i) **DNA and RNA:** DNA is the genetic material and it contains deoxyribose sugar, RNA is not a genetic material and it contains ribose sugar.

(ii) **Brass and Bronze:** (See exercise Ch. 1)

(iii) **Blood and Lymph:** blood is a connective tissue that contains red blood cells, Lymph does not contain red blood cells.

(iv) **Hard water and Heavy water:** (See Ch. 1, portion of Heavy water)

(v) **Small pox and Measles:**

Smallpox, highly contagious viral disease that is often fatal. The disease is chiefly characterized by a skin rash that develops on the face, chest, back, and limbs.

Measles, also rubella, acute, highly contagious, fever-producing disease caused by a filterable virus, different from the virus that causes the less serious disease German measles, or rubella. Measles is characterized by small red dots appearing on the surface of the skin, irritation of the eyes (especially on exposure to light), coughing, and a runny nose.

(vi) **Pig iron and Stainless Steel.** (See exercise Ch. 1)

(vii) **Alloy and Amalgum:**

Ans. Alloy, substance composed of two or more metals. Alloys, like pure metals, possess metallic luster and conduct heat and electricity well, although not generally as well as do the pure metals of which they are formed. Mercury combines with all the common metals except iron and platinum to form alloys that are called amalgams.

(viii) **Isotopes and Isobars:**

Ans. (See solved paper 1998)

(ix) **Artery and Vein:**

Ans. Artery is a blood vessel which transport oxygenated blood away from heart except pulmonary artery. Vein is a blood vessel which transports deoxygenated blood towards heart except pulmonary vein which carries oxygenated.

(x) **Barrage and Dam.** Barrage is used to regulate the flow of water while dam is used to store water.

Q. 8. **Explain the scientific reasons for the following:**

Ans.

(i) **It is not advisable to sleep under trees during the night.**

Ans. Because trees, at night release carbon dioxide gas, while humans need oxygen to breathe. If a person sleeps under trees at night, there are chances of hypoxia to occur in human body that may lead to death due to low oxygen supply.

(ii) **Water boils quicker on mountains.**

Ans. Water boils quicker at mountains due to low partial pressure of air. Boiling temperature is directly proportional to partial pressure. Greater the partial pressure, greater will be the boiling temperature.

(iii) **Rainbow is produced in the sky after rain fall and sunlight.**

Ans. See exercise Ch. 1.

(iv) **Water remains cool in an Earthenware pitcher.** Because Earthenware pitcher contains very small microscopic pores through which water molecules evaporate. When molecules evaporate through these pores they cause cooling in the remaining water. Most of the heat energy is lost in the form of vapors.

(v) **Milk is considered as an ideal food.**

Ans. Because milk contains all essential constituents of diet. Milk contains carbohydrates, fats, proteins, vitamins, antibodies and water. So that milk is considered as an ideal food.

Q. 9. **Which of the following statements are true or false? Only write "True" or "False" in the answer book. Do not reproduce the statement.**

(i)	Urea is a phosphate fertilizer.	**(False)**
(ii)	Cellulose is a natural polymer.	**(True)**
(iii)	Magnetite is the ore of copper	**(False)**
(iv)	Malaria is caused by drinking polluted water.	**(False)**
(v)	The instrument used to measure velocity of wind is Barometer.	**(False)**
(vi)	Our eye is very sensitive to blue light.	**(False)**
(vii)	Sound can not travel through vacuum.	**(True)**

(viii) Enzymes are biological catalyst. **(True)**

(ix) Leprosy is a disorder of Nervous System. **(False)**

(x) Mica is a non-conductor of electricity. **(True)**

Q.10. What are Endocrine glands? Name any four. From which part of the body are the followings secreted:

(i) Insulin **(ii) Thyroxin**

(iii) Adrenaline **(iv) Oestrogen**

(v) Testosterone **(vi) Cortisol**

Ans. **(Discussed in paper 2000)**

Q.11. (a) Name the important parts of a Flower.

Ans. A flower is regarded as a modified stem with shortened internodes and bearing, at its nodes, structures that may be highly modified leaves

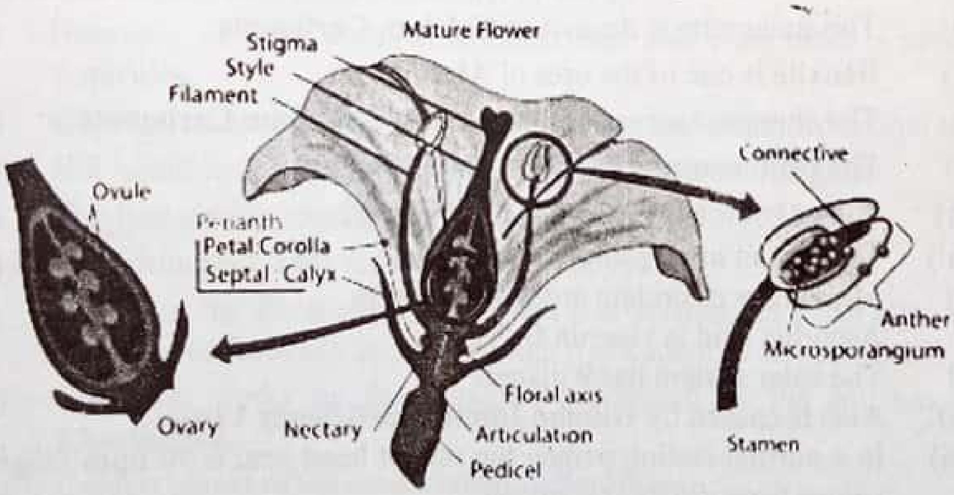
Typical Flower Structure

Calyx: the outer whorl of sepals; typically these are green, but are petal-like in some species.

Corolla: the whorl of petals, which are usually thin, soft and colored to attract insects that help the process of pollination.

Androecium: one or two whorls of stamens, each a filament topped by an anther where pollen is produced. Pollen contains the male gametes.

Gynoecium: one or more pistils. The female reproductive organ is the carpel: this contains an ovary with ovules (which contain female gametes)



(b) Explain the Pollination and Fertilization processes.

Pollination: The transfer of pollen from the anthers of a flower to the stigma of the same flower or of another flower.

Fertilization: the fusion of nuclei from the pollen grain with nuclei in the ovule. Fertilization allows the flower to develop seeds.

Summary - Pollination and Fertilization

Flowers contain the structures necessary for sexual reproduction. The male component, or stamen, consists of a thin stalk called the filament, capped by the anther. The female component, the pistil, includes the stigma, a sticky surface that catches pollen; the ovary, which contains the ovule and embryo sac with its egg; and the style, a tube that connects the stigma and ovary (A)

Pollen is produced in the anther (B), and is released when mature (C) Each mature pollen grain contains two sperm cells. In self-pollinating plants, the pollen lands on the stigma of the same flower, but in cross-pollinating plants—the majority of plants—the pollen is carried by wind, water, insects, or small animals to another flower. If the pollen attaches to the stigma of a flower from the same species, the pollen produces a pollen tube, which grows down the neck of the style, transporting the sperm to the ovule (D)

Within the embryo sac of the ovule, one sperm cell fertilizes the egg, which develops into a seed. The second sperm cell unites with two cells in the embryo sac called polar nuclei, and these results in the development of the endosperm, the starchy food that feeds the developing seed. The ovary enlarges (E) and becomes a fruit.

Q. 12. Write short notes on any FIVE of the following:

(i) Ecosystem (ii) CNG (iii) PVC (iv) Hormones (v) Antibiotics (vi) Ceramics (vii) Green House Effect (viii) Photosynthesis (ix) Pasteurization (x) Vaccine

Ans. See past papers and text portion

Q. 13. What are the factors of water pollution? What types of diseases are transmitted by using polluted the methods to control pollution of water.

See solved paper 1992

Q.14. Fill in the blanks with appropriate words:

(i) The purpose of computer is **store, retrieve, and process information**
(ii) Polio is caused by **Virus**
(iii) The stalagmite is deposit of **Calcium Carbonate**
(iv) Bauxite is one of the ores of **Aluminium**
(v) The chemical name of washing soda is **Sodium Carbonate**
(vi) The main constituent of Sui gas is **Methane**
(vii) **Violet** color has the shortest wave length.
(viii) Glass is an **amorphous** solid.
(ix) Monomers of protein are **Amino Acids**
(x) Ascorbic acid is vitamin **C**
(xi) The solar system has **9** planets
(xii) Aids is caused by **Human Immunodeficiency Virus**
(xiii) In a normal resting person the rate of heart heat is **70 bpm** *(slightly varying values from different sources)*
(xiv) The science which deals with heredity is known as **Genetics**
(xv) In Pakistan Copper mineral is found in **Saindak**
(xvi) The most abundant element in the Earth crust is **Oxygen**
(xvii) **Manometer** is an apparatus used for measuring the pressure of gases.
(xviii) The smallest branches of an artery lead into tiny blood vessels are called **arterioles**
(xix) The living part of a plant cell is composed of a nucleus and **cytoplasm**
(xx) The fastest revolving planet is **Mercury.**

EVERYDAY SCIENCE 2002

Time Allowed: Three Hours **Maximum Marks: 100**

Note: **Attempt any ten questions. All questions carry equal marks.**

Q.1. **Write short notes on any two of the following: 5 each**

(a) **Acid Rain** (b) **Pesticides** (c) **Endocrine system**

Ans. **(See Ch. 1, 1, 2 respectively)**

Q. 2. **Differentiate between any five of the following pairs: (2 each)**

(a) **Rotation and revolution of Earth: (See Ch. 1, Day Night and Seasons)**

(b) **Monocot and dicot plants:** monocots contain one cotyledon in their seeds, dicots contain two cotyledons.

(c) **pollination and fertilization: (See solved paper 2001)**

(d) **Umbra and penumbra: (Solved paper 1997)**

(e) **Nucleus and nucleolus:** nucleus is found in cytoplasm and contains genetic material, nucleolus is present in nucleus and is associated with ribosome synthesis.

(f) **Heavy water and hard water (solved paper1993)**

Q. 3. **Draw a labeled diagram of human eye, indicating all essential parts, discuss its working. (5, 5)**

Ans. (See Ch. 5)

Q. 4. **Fill in the blanks with suitable words: (1 each)**

(a) Heavenly objects, which resembles stars and emit radio waves are called **Asteroids.**

(b) **Geysers** are hot springs that erupt hot water and steam from time to time.

(c) Hot liquid rock beneath the Earth's surface is called **Magma.**

(d) The first simply microscope was invented by **Robert Hook.**

(e) **Mitochondria** is the power house of the cell.

(f) Ability of the air to absorb long heat waves from the Earth after allowing the short waves from sun to pass through it is known as **Green House Effect.**

(g) Computer works on the principle introduced by the Muslim scientist **Al Khawarzmi.**

(h) Coldest planet of the solar system is **Neptune.**

(i) The rupture of red blood cells is called **Hemolysis/Erythrolysis** *(both are correct).*

(j) Muslim Scientist Ali ibn Al-Tabari is famous for his work on **Medicine.**

Q. 5. **What is the solar system? Indicate the position of planet Pluto in it. State the characteristics that classify it as: (5, 1, 4)**

(a) **A planet**

(b) **An asteroid**

Ans. **(See Chapter 1, Solar System)**

Position of Pluto:

Q. 6. Which quantities are measured by the following SI units: (1 each)

(a) Watt ___**power**

(b) Coulomb____ **charge**

(c) Pascal____ **pressure**

(d) Ohm____ **resistance**

(e) Kelvin____ **temperature**

(f) Joule____ **energy,** g. meter____ **length**

(h) Farady____ **electric charge**

(i) Hertz____ **frequency**

(j) Ampere____ **current**

Q. 7. What are minerals? For most of the part minerals are constituted of eight elements, name any six of them. State the six characteristics that are used to identify minerals

Ans. Minerals

Natural substance belonging to a group of inorganic (often crystalline) compounds which are found in the Earth, that which is not animal or vegetable

A mineralis a naturally occurring substance formed through geological processes that has a characteristic chemical composition, a highly ordered atomic structure and specific physical properties

Elements as Parts of Minerals

Oxygen, Silicon, Carbon, Sulphur, Phosphorus, Halogens (Flourine, Chlorine, Bromine, Iodine)

Characteristics to Identify Minerals

Color – this varies depending on the chemicals present and is the least informative in identifying a mineral variety

Luster – what the surface looks like in the light

Specific Gravity – how heavy it feels, heft

Crystal Form – shape of crystal, shape the mineral would take if it had room to grow in a cavity, not massive – some minerals have a number of different crystal shapes

Tenacity - toughness, how cohesive the mineral is, if it falls apart

Hardness – what it can scratch & what scratches it

Transparency - The ability to transmit light. Depending on a number of things, rocks & minerals can also transmit light.

Q. 8. Define any five of the following terms using suitable examples:

(a) **Polymerization:** the process by which small molecules combine to form very high molecular weight molecules is called polymerization. Plastic is made by the process of polymerization.

(b) **Ecosystem**

(c) **Antibiotics**

(d) **Renewable energy resources**

(e) **Gene**

(f) **Software**

Ans. (See text portion)

Q. 9. What do you understand by the term "Balanced Diet? What are its essential constituents? State the function of each constituent (2,3,5)

Ans. (See Ch. 4, Portion of Balance Diet)

Q.10. Which of the following statements are true and which are false? (1 each)

(a) Haploid cells result from the process of mitosis. **(False)**

(b) All stars are of the same colour. **(False)**

(c) The left lung has two lobes while the right lung has three lobes. **(True)**

(d) The pulmonary veins return oxygenated blood to the right atrium. **(False)**

(e) Muslim Scientist Ibn Haitham is famous for his work on planets. **(False)**

(f) Our galaxy milky way is shaped like a large thick concave lens with a large central bulge.**(True)**

(g) DNA has a double helix structure while the RNA does not have a double helix structure. **(True)**

(h) The normal temperature of Human Blood is 37°C (98.6 F) **(True)**

(i) The liver is a part of gastrointestinal tract. **(True)**

(j) Movement of tectonic plates may cause eruption of a volcano. **(True)**

Q.11. What do the following scientific abbreviations stand for? (1 each)

(a) LASER—light amplification emission of radiation.
(b) RADAR—radio amplification and ranging.
(c) LPG—liquid petroleum gas.
(d) PVC—polyvinyl chloride.
(e) CFC—chlorofluoro carbo.
(f) AIDS—acquired immuno deficiency syndrome.
(g) ROM—read only memory.
(h) LAN—local area networking.
(i) WWW—world wide web.
(j) DNA—deoxyribo nucleic acid.

Q.12. Give brief scientific reasons for any five of the following statements: (2 each)

(a) Lunar eclipse lasts much longer than solar eclipse.
(b) Goiter is common in people living in hilly areas.
(c) Mixture of ice and salt (sodium chloride) is used as a freezing mixture.
(d) Detergents are better cleaning agents compared to soap.
(e) Decomposers are important for life on land and water.
(f) Places near the sea are cooler in summer and warmer in winter than places farther inland.

Q. 13. Name (1 each)

(a) A disease caused by deficiency of vitamin C. **(Scurvy)**
(b) The major fossil fuel impurity. **(Sulphur)**
(c) The instrument used to measure degree of humidity. **(Hygrometer)**
(d) An ore of Zinc. **(Zinc Blend)**
(e) Two most abundant elements present in the sun. **(Hydrogen & Helium)**
(f) The metal atom present in chlorophyll. **(Magnesium)**
(g) The gland responsible for the secretion of the hormone estrogen. **(Ovary)**
(h) An element used in the doping of silicon for the preparation of a p-type semiconductor. **(Boron or Aluminium)** *(both are correct)*

(i) A synthetic fibre which is a polyamide. **(Nylon)**

(j) Major constituent of Biogas. **(Methane)**

Q.14. What are fertilizers? What do you understand by the term NPK fertilizer? How do fertilizers contribute to water pollution? (3,1,6)

Ans. (See portion of fertilizers, Ch. 1)

Q.15. Choose the one alternative the best completes the statement or answer the question (1 each)

(1) Glycogen is an example of

(a) **Carbohydrate** (b) Peptide
(c) Lipid (d) steroids

(2) The cell structure that controls movements of material into and out of the cell is the

(a) Mitochondria (b) Cell membrane
(c) Centriole (d) **Golgi body**

(3) The unit that co-ordinates different devices of the computer system is

(a) ALU (b) Register
(c) **Control unit** (d) Logical instructions

(4) ________manages and controls various functions of the computer

(a) Input/output device (b) Main memory
(c) **Operating system** (d) Both (a) & (b)

(5) The number of natural satellite orbiting around the planet Mars is

(a) 1 (b) **2**
(c) 5 (d) 14

6) _________ is an example of mechanical digestion

(a) Glycolysis (b) Hydrolysis
c) **Mastication** (d) Defecation

(7) Botanically a fruit is a/an

(a) Ripened ovule (b) Mature stigma
(c) **Ripened ovary** (d) Fully mature flowering stalk

(8) The vocal folds are part of the

(a) Nasal cavity (b) **Larynx**
(c) Trachea (d) Laryngopharyn

(9) Blood glucose is raised by all of the following except

(a) Glycogen (b) **Insulin**
(c) Cortisol (d) Epinephrine

(10) The famous book Al-Qanoon was written by the Muslim scientist

(a) Jabir-ibn-Hayan (b) Zakriya Al-Razi
(c) **Abu Ali Sina** (d) Abul-Qasim Majreeti

EVERYDAY SCIENCE 2003

Time Allowed: Three Hours **Maximum Marks: 100**

Note: Attempt any ten questions. All questions carry equal marks.

1. Write short notes on any two of the following:

(a) **Microwave oven:** (See solved paper 2001)

(b) **Optic fibre:** Optical fiber refers to the medium and the technology associated with the transmission of information as light pulses along a glass or plastic wire or fiber. Optical fiber carries much more information than copper wire. Most telephone company long-distance lines are now of optical fiber.

Transmission on optical fiber wire requires repeaters at distance intervals. The glass fiber requires more protection within an outer cable than copper. For these reasons and because the installation of any new wiring is labor-intensive, few communities yet have optical fiber wires or cables from the phone company's branch office to local customers. A type of fiber known as single mode fiber is used for longer distances; multimode fiber is used for shorter distances.

(c) **Biotechnology**: The simplest definition of biotechnology is "applied biology" and the application of biological knowledge and techniques to develop products. It may be further defined as the use of living organisms to make a product or run a process. By this definition, the classic techniques used for plant and animal breeding, fermentation and enzyme purification would be considered biotechnology. Some people use the term only to refer to newer tools of genetic science. In this context, biotechnology may be defined as the use of biotechnical methods to modify the genetic materials of living cells so they will produce new substances or perform new functions. Examples include recombinant DNA technology, in which a copy of a piece of DNA containing one or a few genes is transferred between organisms or "recombined" within an organism.

2. Give names of the members of the solar system. Briefly write down main characteristics of:

(a) Mars **(b) Venus**

Ans. (See Ch. 1, Solar System)

Q. 3. Name:

(a) The instrument used for the measurement of blood pressure: **sphygmomanometer**

(b) A mammal, which can fly: **bat**

(c) A disease which is more common in men than in women and is hereditary in character: **diabetes mellitus**

(d) One endangered animal species of Pakistan: **blind dolphin**

(e) An ore of mercury: **Cinnabar**

(f) A cyanobacterium: **Nostoc**

(g) A hormone secreted by pancreas: **insulin**

(h) The nuclear reaction taking place on the surface of sun: **fusion reaction**

(i) The scientist who discovered sulfuric acid: **Jabir bin Hayan**

(j) The constituent elements of brass: **Zinc and Copper**

Q. 4. What do the following scientific abbreviations stand for?

(a) **SONAR:** **SO**und **NA**vigation and **R**anging

(b) **SARS:** severe acute respiratory syndrome

(c) **NTP:** network time protocol

(d) **RQ:** respiratory quotient

(e) **PVC:** polyvinyl chloride

(f) **NPN:** negative positive negative

(g) **WAN:** wide area network

(h) **ECG:** electro cardio gram

(i) **CPU:** central processing unit

(j) **BCG:** bacillus calmette Guerin

Q 5: What are pesticides? discuss their classification commonly in use with agronomists.

Ans. (See Ch. 1, portion of Pesticides)

Q 6: Define any five of the following:

Acoustics: The science of sound dealing with the production, effects, and transmission of sound waves through various mediums. Includes the effects of reflection, refraction, diffraction, absorption, and interference.

Quartz: It is a hard glossy mineral consisting of silicon dioxide in crystal form; present in most rocks (especially sandstone and granite); yellow sand is quartz with iron oxide impurities. It is a mineral composed of the elements silicon and oxygen (silicon dioxide) that occurs in multiple forms.

Cross Pollination: Mixing the pollen of one flowering plant with another to create a hybrid. It is done by transfer of pollen from one flower to another of a different variety but of same species.

Allele: Each member of a gene pair is called an allele.

Optical Illusion: drawing or object that appears to have an effect that it does not really have, such as when a flat painting seems to have three-dimensional depth. When something appears different than it actually is.

Ovulation: The release of an egg (or eggs) from the ovary.

Aqua Regia: Aqua regia is a 3:1 mixture of hydrochloric acid and nitric acid. Aqua regia is used to test gold and platinum.

Q. 7: Which physical quantities are measured by the following units:

(a) **Pascal** - Sound Pressure

(b) **Torr** - Pressure

(c) **Curie** - Intensity of radioactivity

(d) **Angstrom** - Unit of length

(e) **Light year** - The distance light travels in a year

(f) **Dioptre** - Lens refractive power

(g) **Horse power** - Unit of Power

(h) **Radian** - Unit of angular measure

(i) **Candela** - Unit of luminous intensity

(j) **Mole** - unit of molecular weight

Q. 8: Explain the structure of Earth and its Atmosphere

Ans. (See Ch. 1, portion of Earth and its atmosphere)

Q. 9: Fill in the blanks:

The conversion of non-diffusible substances into diffusible ones by the action of enzymes in called **Digestion.**

Diamond is the purest naturally occurring crystalline form of **Carbon.**

Caustic soda is extensively used for making **Detergents.**

When a person can see nearer objects but not the distant ones he is said to be suffering from **nearsightedness (myopia).**

Marble is **metaphoric** rock.

Curie is a unit of **radioactivity.**

The brown colour of rust is because of **oxidation.**

The movement of food through esophagus is by the muscular action known as **peristalsis.**

Granite is a form of **Igneous rock.**

Cellulose is the main chemical substance in the plant cell wall:

Cell was first discovered by Robert Brown:

Q 10. What are Endocrine Glands? Name any two from which of the body are the following secreted:

Ans. (See Ch. 2, portion of Hormones and Endocrine glands)

Q. 11. Chose the best choice in the following statements:

1. **Enzymes are organic catalysts made up of:**

(a) Carbohydrate (b) **Proteins**

(c) Fats (d) Nucleic Acid

2. **A nanometer is:**

(a) 10^{-3} meters (b) 10^{-6} meters

(c) **10^{-9} meters** (d) 10^{-12} meters

3. **The minimum speed of a Pentium II computer is:**

(a) 133 Mhz (b) 233 Mhz

(c) **333 Mhz** (d) 433 Mhz

4. **According to recent classifications the living organisms are divided into number of kingdoms:**

(a) 2 (b) 3

(c) 4 (d) **5**

5. **Glycolysis is a process of:**

(a) Photosynthesis (b) Reproduction

(c) Transpiration (d) **Respiration**

6. **The Unit that coordinates different devices of Computer system is:**

(a) ALU (b) Register

(c) Control Unit (d) Logical Instruction

7. Seed is technically:

(a) Ripened Ovule (b) Carpel

(c) Ripened Ovary (d) fully mature pollen grain

8. **ADH is a hormone secreted by:**

(a) Anterior pituitary (b) posterior pituitary

(c) Adrenal Cortex **(d) Adrenal Medulla**

9. **The number of natural satellites orbiting around the Mars is:**

(a) 1 **(b) 2**

(c) 5 (d) 14

10. **Permian Period belongs to:**

(a) Palaeozoic era (b) Mesozoic era

(c) Coenozoic era (d) Precambrian era

Q. 12. Differentiate between the following pairs:

(a) Lava and Magma:

Molten rock, when it is still beneath the earth's surface is Magma, and "lava" after it has erupted.

(b) Ultraviolet and infrared:

Ultraviolet: Electromagnetic radiation with wavelengths below 230 nanometers are called UV radiations.

Infrared: Electromagnetic radiation in the portion of the spectrum just beyond the red portion of visible light. Their wavelength is more than 760 nanometers.

(c) Fault and Fold:

Fault: The line of fracture along which one section of the Earth's crust displace relative to another section, as a result of vertical or horizontal movement of earth.

Fold: In geology, bends in layered, or stratified rocks. Most stratified rocks were originally sediments laid down as horizontal or near-horizontal layers, or beds. However, not only have they solidified, but they are usually inclined, or dip, in one direction or another, and they have been tilted.

(d) Caustic Soda and Caustic Potash:

Caustic Soda: A common name for sodium hydroxide strongly alkaline caustic used in manufacturing soap and paper and aluminum and various sodium compounds

Caustic Potash: It is potassium hydroxide, often used in agriculture and industry

(e) S.E.M. and T.E.M.

S.E.M.: Scanning electronic microscope an electronic microscope that produces a three-rdimensional image, allowing the surface stucture of a specimen to be examined.

T.E.M.: Transmission electronic microscope.

Q.13. Which of the following statements are true and which are false?

(a) Right kidney in man is slightly lower in position than the left kidney. **(True)**

(b) Light is not visible. **(True)**

(c) Steel is more elastic than rubber. **(True)**

(d) Pitch of man's voice is greater than that of woman. **(False)**

(e) Diastolic blood pressure is greater than systolic blood pressure: **(False)**

(f) Base metal can be converted into gold by heating. **(False)**

(g) Guava contains more vitamin C than orange. **(True)**

(h) A light year is a unit of time. **(False)**

(i) Mercury is heavier than lead. **(True)**

(j) Movement of tectonic plates may cause eruption of a volcano: **(True)**

Q.14. Give scientific reason of the following:

(a) Colour blindness is more common in men than in women: Women have the sex chromosomes XX, while men have the chromosomes XY. The gene for normal colour vision is found on the X-chromosome. If a woman has one X-chromosome with the gene and one without it, she will not be colour blind. On the other hand, a man with an X-chromosome that is missing the gene has no 'backup'. He will definitely be colour blind. Colour blind women have both X-chromosomes missing the colour vision gene. This is less probable mathematically than having just one X-chromosome missing the gene.

(b) Light coloured clothes are generally worn in summer: light coloured dresses are usually worn in summer because light colours such as white colour are good reflectors of heat and light as compared to dark colours.

(c) A person is hurt more when he falls on hard ground than on soft: because when a person falls on a soft ground, the softness of the ground absorbs the energy of a falling person and acts as a shock absorber for the falling person.

(d) Deforestation causes more floods: Trees and Forests act as natural barriers in the way of flowing water. When these trees are cut the natural barriers ultimately vanish and more floods are caused.

(e) The man-hole covers are generally round

Ans. (See solved paper 2004)

EVERYDAY SCIENCE 2004

Maximum Marks: 100

Time Allowed: Three Hours

Note: Attempt any ten questions. All questions carry equal marks.

1. **Write short notes on any two of the following:**

(a) **Superconductivity:**

The pairing of electrons in certain materials when cooled below a critical temperature, causing the material to lose all resistance to electricity flow. Superconductors can carry electric current without any energy losses.

About one third of all metals loose all electrical resistance at temperatures below a specific critical temperature. Many elemental metals are superconductors.

Some critical temperatures are: lead Tc = 7.2 K, tin Tc = 3.7 K, niobium Tc = 9.2 K, aluminum Tc = 1.2 K, mercury Tc = 4.2 K, and vanadium Tc = 5.3 K.

Superconducting wires can carry currents with zero losses up to very high current densities. Above a critical current density Jc, superconductivity is suppressed. A typical critical current density is 106 A/cm2. Superconductivity is also supressed by strong magnetic fields.

(b) Night Vision Technology

Night vision works in the basis of the following two technologies

- **Image enhancement:** – This works by collecting the tiny amounts of light, including the lower portion of the infrared light spectrum, that are present but may be imperceptible to our eyes, and amplifying it to the point that we can easily observe the image.
- **Thermal imaging:** – This technology operates by capturing the upper portion of the infrared light spectrum, which is emitted as heat by objects instead of simply reflected as light. Hotter objects, such as warm bodies, emit more of this light than cooler objects like trees or buildings.

(c) **Seismograph:**

A measuring instrument for detecting and measuring the intensity and direction and duration of movements of the ground (as an earthquake). It senses and records the vibrations that radiate out from the earthquake focus. It is a machine for measuring the intensity of earthquakes by recording the seismic waves that they generate.

2. **Briefly write down characteristics of: (5 each)**

(a) **Mercury** (b) **Pluto**

Ans. (See Ch. 1)

3. **Name:**

(a) The desert mammal which does not drink water: **Knagaroo Rat.**

(b) The mixture which can dissolve platinium: **Aqua regia.**

(c) The constituent elements of Bronze: **Tin and Copper.**

(d) The vitamin whose deficiency causes a disease called beri beri: **Thiamine(B1).**

(e) The electrical device which transform voltage: **transformer.**

(f) A nuclear reaction in which two or more than two lighter nuclear are fused together to form a relatively heavier one: **nuclear fusion.**

(g) The purest naturally occurring crystalline form of carbon: **diamond.**

(h) The hormone secreted by adrenal cortex: **aldosterone.**

(i) The three colours combination which produces the sensation of white light: **Red green and blue.**

(j) The defect of vision because of which a person cannot see distant objects clearly: **Myopia or Short sightedness.**

Q. 4. What are fertilizers? What do you understand by the term NPK fertilizer? How does fertilization contribute to the pollution?

Ans. (See Ch. 1, portion of Fertilizers)

Q. 5. Write briefly about any five of the following:

(a) Nuclear radiation: nuclear radiations are the radiations emitted by radioactive elements like uranium, radium and thorium etc. There are three types of radiations named alpha, beta and gamma rays. Alpha particles carry positive charge, beta carry negative while gamma rays carry no charge.

(b) Theodolite: An instrument used in surveying to measure horizontal and vertical angles with a small telescope that can move in the horizontal and vertical planes.

It is a key tool in surveying and engineering work, but theodolites have been adapted for other specialized purposes in field like meteorology and rocket launch technology.

(c) Dialysis: In medicine, dialysis is primarily used to provide an artificial replacement for lost kidney function (renal replacement therapy) due to renal failure. Dialysis may be used for very sick patients who have suddenly but temporarily, lost their kidney function (acute renal failure) or for quite stable patients who have permanently lost their kidney function (end stage renal failure)

(d) Enrichment of Uranium:

In nature, uranium atoms exist in several forms called isotopes - primarily uranium-238, or U-238, and uranium-235, or U-235. In a typical sample of natural uranium, most of the mass (99.3%) would consist of atoms of U-238, and a very small portion of the total mass (0.7%) would consist of atoms of U–235.

To enrich the uranium, a process called gaseous diffusion was developed by the United States in the 1940s. The gaseous diffusion process creates two products: enriched uranium hexafluoride, and depleted uranium hexafluoride (depleted UF6)

(e) Richter Scale: A scale for measuring the magnitude of an earthquake devised by the American seismologist Charles Richter. The device measures the tremors originates during the earth quake and shows its intensity on scale which is from 1 to 10, ten being the highest while one is the lowest of scales in terms of intensity of earth quake.

(f) Aqua regia: Aqua regia is a 3:1 mixture of hydrochloric acid and nitric acid. Aqua regia is used to test gold and platinum.

(g) Iodized salt: Physical manifestations of iodine deficiency (IDD) include mental retardation, coordination abnormalities, deaf-autism, spastic diplegia (spastic paralysis of the lower limbs) and dwarfism. During childhood, mild IDD can result in permanent intellectual impairment, with the intelligence quotient lowered by 10-15 points.

To overcome the deficiency, Salt has become the most accepted food for iodine fortification because it is one of the few commodities that is almost universally consumed by all sections of a community, and at approximately the same level throughout the year, irrespective of economic level.

Q. 6. Which physical quantities are measured by the following units?

(a) **Rutherford:** Atomic Spectrum
(b) **Torr:** Atmospheric pressure
(c) **Fermi:** metric unit of length for measuring nuclear distance
(d) **Sved berg unit:** sedimentation rate
(e) **Diopter:** refractive power of a lens
(f) **Mho:** conductance
(g) **Henry:** inductance
(h) **Maxwell:** magnetic flux
(i) **Becquerel:** radioactivity
(j) **Kilo watt hour:** Energy

Q. 7. What are the various sources of energy? How does energy is produced in the surface of the sun? What will be the future of the sun?

Ans. (See Ch. 1, portion of sources of energy, nuclear fusion)

Q. 8. Which are the following statements true and which are false?

(a) A six feet tall lady can see her full image in a three feet Plane Mirror: **(True)**
(b) Vanadium, a steel gray corrosion resistant metal occur naturally in oxide state: **(False)**
(c) Fibre optics cable carries data in the form of light: **(True)**
(d) Blue flame is hotter than red flame: **(True)**
(e) The falling of yellow leaves during autumn is the seasonal time for plants to get rid of accumulated wastes: **(True)**
(f) Friction is necessary evil: **(True)**
(g) There are 9.5×10^{15} m in one light year. **(True)**
(h) The velocity of a moving object is least where the pressure is greatest **(False)**
(i) Heat reaches earth from the sun by means of convection: **(False)**
(j) Meningitis is the inflammation of liver: **(False)**

Q. 9. Differentiate between the following pairs:

(a) Periscope & pyrometer: periscope is an optical instrument used in submarines to see the objects above the head surface. Pyrometer is a meter used to measure very high temperature.

(b) Cell & battery: Cell is a small unit/device that delivers an electric current as the result of a chemical reaction. Battery is a device that produces electricity having several cells arranged in parallel or series.

(c) Perimeter & altimeter: perimeter is the outer boundary of a figure or area; total length of the outer boundary. Altimeter is an instrument for determining altitude attained, especially a barometric or radar device fitted in an aircraft.

(d) Pelage and plumage: pelage is growth of hair/fur/wool covering the skin of animals while plumage are feathers covering the body of birds.

(e) Smog and smoke: Smog is formed by the interaction of pollutants present in the air in presence of sun light (photochemical smog, it usually restricts visibility and is hazardous to health). Smoke is the thin fine particles usually result from the combustion.

Q. 10. Fill in the blanks:

(a) The largest planet of solar system is **Jupiter.**

(b) The temperature of the dead human body on Celsius scale is **according to the temperature around the body.**

(c) For a large span of a long jump. two things are taken into account viz (i) angle with which one jumps and (ii) **velocity.**

(d) The number of the spinal nerves in the man is **31** pairs

(e) A primary cell can **not** be charged again. (not)

(f) Halos around the moon are formed because of the phenomenon of **dispersion of light.**

(g) Scattering of light **determines** the duration of the day.

(h) Muscle stiffness is caused by a disease called **Tetanus.**

(i) Oil rises in a wick of oil lamp on account of a property of matter called **Capillary action.**

(j) Muslim scientist Ali al Tabari is famous for his work on **medical sciences.**

Q. 11. Give scientific reason of the following:

1. Rain water is more fertile than water from tube well: after falling, the rain drops start moving on slope side, during this movements, the soluble salts and minerals solves from top soil in the flowing water, which increases its fertility, while the rain drops which percolates into deeper regions of soil are note able to absorb more salts and minerals so is less fertile as compared to rain water in streams.

2. The man-hole covers are generally round: Manhole covers are round so that the round shape distributes the external pressure equally in all directions. So that it has more ability to bear external pressure, like heavy traffic to reduce the chances of accidents.

3. Clothes of a moving dancer bulge: due to movement of dancer the clothes got electric charge, which on fast movement collides with the opposite charge so the clothe bulge inside out.

4. Peoples are advised not to stand near a fast moving train: people are advised not to stand near a fast moving train as the train in tremendous speed cuts the pressure of air which can misbalance the objects after passing of train present near the railway line

5. The image of a tree looks inverted on the bank of a lake: this is due to the law of reflection according to which image is formed far and inverted

Q. 12. Why are the scientists worried about the increase of carbon dioxide gas in the atmosphere? Is there any possible benefit for the mankind in case of global warming?

Ans. (See Ch 1. portion of Global Warming).

BENEFITS OF GLOBAL WARMING:

(i) **There would be more water for agriculture**

(ii) **Dams can be filled to store water**

(iii) **The stored water can be used to generate electricity**

Q. 13. What do the following scientific abbreviations stand for?

(a) **STP** standard temperature and pressure

(b) **ATP** Adenosine Tri-Phosphate

(c) **PNP** Positive-Negative-Positive (transistor)

(d) **LAN** local area network

(e) **KWh** kilo watt hour

(f) **BTU** British Thermal Unit

(g) **LDL** Low-density lipoprotein

(h) **ROM** Read only memory

(i) **MAF** million acre feet

(j) **SONAR** Sound Navigation and Ranging

Q. 14. Match the column A and B but write the answers serial wise in column C

S. No	Column (A)	Column (B)	Column C
A	Frank whittle	Fission	Jet Engine
B	Addison	Electricity	Electricity
C	Hahn	Genetics	Fission
D	Mendel	Lightening Conductor	Genetics
E	Benjamin Franklin	Steam Engine	Lightning Conductor
F	Bardeen & Brattin	Uncertaininty principle	Fusion
G	Heisenberg	Jet engine	Uncertainity Principle
H	Fermi	Cyclotron	Length
I	Lawrence	Electro magnetic waves	Cyclotron
J	Maxwell Hertz	Fusion	Electro Magnetic Waves
K	James Watt	Length	Steam Engine

Q. 15. Choose the best choice in the following statements.

1. **The three elements needed for healthy growth of plants are:**

(a) **N, P, K** (b) N, C, P

(c) N, K, C (d) N, S, P

2. **The most abundant element in the human body is:**

(a) Carbon (b) Hydrogen

(c) **Oxygen** (d) Nitrogen

3. **Ammonium nitrate is not used for:**

(a) **Rice crop** (b) Wheat crop

(c) Sugarcane crop (d) Cotton crop

4. **Sea divers use a mixture of gases for breathing during diving. The mixture is:**

(a) 80% He & 20%O_2 (b) **80% N_2 & 20 O_2**

(c) 20%O_2 & 40% N_2 40% CO_2 (d) 50% He & 50% O_2

5. **Which one of the following is a water soluble vitamin?**

(a) Niacin (b) **Ascorbic acid**

(c) Trypsin (d) Riboflavin

6. Which of the following enzymes bring about hydrolysis of fats?

(a) Urease (b) Zymase
(c) Maltase **(d) Lipase**

7. The solution of which acid is used for seasoning of food:

(a) Formic acid (b) Acetic acid
(c) Benzoic acid (d) Botanic acid

8. Influenza is caused by:

(a) Fungi (b) Bacteria
(c) Virus (d) Protoza

9. The blood glucose level is raised by the following except:

(a) Carbohydrates (b) Cholesterol
(c) Insulin (d) Epinephrine

10. The energy possessed by water in a dam is:

(a) Electrical energy (b) Kinetic energy
(c) Potential energy (d) Mechanical energy

EVERYDAY SCIENCE 2005

PART I

Q. 1. Write short notes on any TWO of the following: (5 each)

(a) Communication Satellite: A communications satellite is an artificial satellite stationed in space for the purposes of telecommunications. Modern communications satellites use geosynchronous orbits, Molniya orbits or low Earth orbits. For fixed services, communications satellites provide a technology complementary to that of fiber optic submarine communication cables. For mobile applications, such as communications to ships and planes, for which application of other technologies, such as cable, are impractical or impossible.

(b) Geo-thermal Energy: The name "geothermal" comes from two Greek words: "geo" means "Earth" and "thermal" means "heat". Geothermal Energy is energy from heat inside the Earth. The centre of the Earth is around 6000 degrees Celsius - hot enough to melt rock. Even a few kilometers down, the temperature can be over 250 degrees Celsius. In general, the temperature rises one degree Celsius for every 36 meters you go down. In volcanic areas, molten rock can be very close to the surface. Geothermal energy has been used for thousands of years in some countries for cooking and heating.

(c) Ultrasonic: Ultrasound is sound with a frequency greater than the upper limit of human hearing, approximately 20 kilohertz. Some animals, such as dogs, dolphins, and bats, have an upper limit that is greater than that of the human ear and thus can hear ultrasound.

Ultrasound has industrial and medical applications. Medical Sonography (also called ultrasonography) can visualise muscle and soft tissue, making them useful for scanning the organs, and obstetric sonography is commonly used during pregnancy. Typical diagnostic ultrasound scanners operate in the frequency range of 2 to 13 megahertz. More powerful ultrasound sources may be used to generate local heating in biological tissue, with applications in physical therapy and cancer treatment. Focused ultrasound sources may be used to break up kidney stones or for cataract treatment by phacoemulsification.

Q. 2. Write short notes on the life and work of the following: (5 each)

(a) Al-Biruni **(b) Ibn Al-Haitham**

Ans. (See Appendices)

Q. 3. Name: (1 each)

(a) The alloy which consists of copper and tin:

Ans. Bronze

(b) The device used to measure radioactivity:

Ans. Geiger counter

(c) The organ in the human body which is responsible for the digestion of protein only:

Ans. Stomach

(d) The instrument used to measure very high temperature:

Ans. Pyrometer

(e) The scientist who designed the first internal combustion engine used to burn low grade fuel:

Ans. Francois Isaac de Rivaz

(f) The scientist who asserted the earth to be a huge magnet:

Ans. **William Gilbert**

(g) The metal known as quick silver:

Ans. **Mercury**

(h) The device which converts the chemical energy into electrical energy:

Ans. **Battery**

(i) The first person to orbit the earth in space:

Ans. **Yuri Gagarin**

(j) The scientist who discovered water:

Ans. **Antoine Lavoisier**

Q. 4. Write briefly about any FIVE of the following: (2 each)

Ans.

(a) Shock Waves: In fluid dynamics, a shock wave is a nonlinear or discontinuous pressure wave. It can also be when the actual molecular or particle speed is moving faster than the wave propagation speed (space shuttle through air) They can and do transport and transmit tremendous amounts of energy (hundreds of Megawatts per square meter for shocks generated by nuclear explosions)

(b) Sound Barrier: In aerodynamics, the sound barrier is the apparent physical boundary stopping large objects from becoming supersonic. The term came into use during World War II when a number of aircraft started to encounter the effects of compressibility. a grab-bag of unrelated aerodynamic effects, and fell out of use in the 1950s when aircraft started to routinely "break" the sound barrier.

(c) Solar Cell: A solar cell, or photovoltaic cell, is a semiconductor device consisting of a large-area p-n junction diode, which, in the presence of sunlight is capable of generating usable electrical energy. This conversion is called the photovoltaic effect. The field of research related to solar cells is known as photovoltaic.

(d) Super Fluid: Super fluidity is a phase of matter characterized by the complete absence of viscosity. Thus super fluids, placed in a closed loop, can flow endlessly without friction. Super fluidity was discovered by Pyotr Leonidovich Kapitsa, John F. Allen, and Don Misener in 1937. The study of super fluidity is called quantum hydrodynamics.

(e) Tsunami: Tsunami is a natural phenomenon consisting of a series of waves generated when water in a lake or the sea is rapidly displaced on a massive scale. Earthquakes, landslides, volcanic eruptions and large meteorite impacts all have the potential to generate a tsunami. The effects of a tsunami can range from unnoticeable to devastating.

(f) Photovoltaic Cell

Ans. Same As Solar Cell.

(g) Hygrometer: Hygrometers are instruments used for measuring humidity. The simplest form of a hygrometer consists of two thermometers, one of which has its bulb constantly kept wet. Evaporation from the bulb lowers the temperature so that this thermometer usually shows a lower temperature.

Q. 5. Which physical quantities are measured by the following units? (1 each)

(a) Coulomb___

Ans. **Unit of electrical charge**

(b) Weber___

Ans. Unit of magnetic flux

(c) Tesla ___

Ans. Unit of magnetic flux density

(d) Siemen___

Ans. Unit of conductance

(e) Rutherford___

Ans. Unit of rate of decay of radioactive material

(f) Faraday ___

Ans. Unit of electric charge

(g) Angsfrom___

Ans. Unit of length

(h) Parsec___

Ans. Unit of astronomical length

(i) Degree___

Ans. Unit of measurement of an angle

(j) Steradian___

Ans. Unit of solid angle measurement

Q. 6. How do our domestic and industrial activities pollute water? Explain with reference to two important industries of Pakistan. (5,5)

Ans. (See Solved Paper 1994)

Q. 7. Which of the following statements are True and which are False: (1 each)

(a) To stay in the sunlight while circling the globe at the equator, one has to move with a speed of 1670 km/hour. **(True)**

(b) Infrared waves have more wavelengths than the red colour. **(True)**

(c) Liver produces bile which is involved in the breakdown of fats. **(True)**

(d) A secondary cell can be charged again. **(True)**

(e) Nucleic acids are responsible basically for protein synthesis in the human body. **(True)**

(f) The quality of gasoline is checked by its octane number. **(True)**

(g) Image in a plane mirror is not laterally inverted **(False)**

(h) Horse power is the unit of mechanical energy. **(False)**

(i) Sound travels faster in vacuum than in water. **(False)**

(j) Nitrogen is the most occurring element in the human body. **(False)**

Q. 8. Differentiate between the following pairs. (2 each)

(a) Radiotherapy & Chemotherapy:

Ans. Radiotherapy: Radiation therapy (or radiotherapy) is the medical use of ionizing radiation as part of cancer treatment to control malignant cells.

Chemotherapy: Chemotherapy is the use of chemical substances to treat disease.

(b) Penumbra & Umbra

Penumbra: The penumbra (Latin for mid-shadow) is the portion of a shadow that results from the source of illumination being only partially blocked. Penumbras only occur when the source of light is not a point-source. As the sun is a visible disc, solar shadows have penumbras. The penumbra part of a shadow is contrasted with the umbra part of the shadow in which the light source is completely blocked.

Umbra: The umbra (Latin for shadow) is the darkest part of a shadow. From within the umbra, the source of light is completely blocked by the object causing the shadow. This contrasts with the penumbra where the light source is only partially blocked and there is only a partial shadow.

(c) Springtides & Neap tides:

Neap Tides: When the moon is at first quarter or last quarter, it's located at right angles to the sun. Then the gravity of the sun and moon pull at cross-purposes, and the range between high and low tides is at its least. These are *neap tides*, and at such times the difference between high and low tides might be only inches a day.

Spring tides: whenever there's a full moon or a new moon, the Earth, sun and moon make a straight line – more or less – in space. Then the sun and moon's gravity combine to create extremely high and low tides, known as *spring tides*.

(d) Vertebrates &. Invertebrates:

Vertebrates: Living Beings which do have vertebral column or backbone are said to be vertebrates.

Invertebrate: Invertebrate is a term to describe any animal without a vertebral column. It therefore includes all animals except vertebrates.

(e) Fluorescent light & Neon signs:

Florescent Light: The common fluorescent tube relies on fluorescence. Inside the glass tube is a partial vacuum and a small amount of mercury. An electric discharge in the tube causes the mercury atoms to emit light. The emitted light is in the ultraviolet range and is invisible, and also harmful to living organisms, so the tube is lined with a coating of a fluorescent material, called the phosphor, which absorbs the UV and re-emits visible light.

Neon Signs: Neon signs are produced by the craft of bending glass tubing into shapes. A worker skilled in this craft is known as a glass bender, neon or tube bender.

The neon sign is an evolution of the earlier Geissler tube (also called a Crookes tube), which is a glass tube for demonstrating the principles of electrical discharge.

Q. 9. Fill in the blanks: (1 each)

(a) The variation in the blood flow can be heard with an instrument called **stethoscope.**

(b) There is a place in the retina where the light sensitive cells are interrupted by the presence of the optic nerve head. It is known as **Blind Spot.**

(c) The study of human population is called **Demography**.

(d) Human beings belong to species called **sapiens.**

(e) Defect of eye due to which nearly located objects are not clearly visible is called **Farsightedness also called Hypermetropia.**

(f) About **65%** of the human body consists of water.

(g) All of the oxygen that you breathe has been produced by the splitting of water during **Photosynthesis.**

(h) The important ore of Chromium is **Chromite.**

(i) **Nitric** acid was discovered by Jabbar bin Hayyan. (HCL was also discovered by him).

(j) The measurement of rainfall is made by an instrument known as **rain gauge**.

Q. 10. What are the main reasons of water - logging in Pakistan? How does a tube-well reclaim a water logged soil? (5,5)

PART II

Q. 11. Give scientific reason of the following: (2 each)

Ans. **(1) Pole star is always seen in the north:** Polar star is present in the center of equatorial line. We live in the south to the equatorial line that's why it is seen in north to us.

(2) We never see birds urinating: Due to deficiency of water, Birds excrete uric acid which is in crystalline form, so that we do not see birds urinating.

(3) Pasteurized milk has more nourishment than the ordinary boiled milk: Because its nurmally refrigerated, covered and protected. It is heated for a very short time, which not only kills the microbes but also prevents the delicate proteins and vitamins to loose.

(4) Bees die when they sting human beings: when bee stings the human being, the sack filled with poison, present in the abdomen, is ruptured and poison is released in the human body as well inside the body of bee. This poison kills the bee.

(5) Cloudy nights are usually warmer than the clear ones:

Ans. Cloudy nights are warmer than the clear nights because of the phenomenon of green house effect.

Q. 12. What are Nuclear reactors? How the Electrical energy is produced by Nuclear Power Plants?

Ans. (See chapter 1, portion of Nuclear Reactor)

Q. 13. Name the devices which convert:

(1) Mechanical energy into electrical energy___ **Electric Generator/ Dynamo**
(2) Heat energy into mechanical energy___ **Combustion Engines**
(3) Electrical energy into mechanical energy___ **Electrical Motors**
(4) Electrical energy into sound energy ___ **Speakers**
(5) Sound energy into electrical energy___ **Microphone**

Q. 14. What do the following scientific abbreviations stand for? (1 each)

(a) LDL – **low density lipoproteins**
(b) McV – **Mean Cell Volume** (c) UHF – **Ultrahigh Frequency**
(d) LED – **Light-Emitting Diode** (e) LCD – **Liquid Crystal Display**
(f) BASIC – **Beginner's All-Purpose Symbolic Instruction Code**
(g) MASER – **Microwave Amplification by Stimulated Emission of Radiation**
(h) ETT – **Educational Telecommunications and Technology**
(i) HST – **High-Speed Train or Hubble space telescope**
(j) DBS – **Direct Broadcast Satellite or Direct Broadcasting by Satellite.**

Q. 14. Compare the columns A and B and write the correct answer from the Column to the Column A (serial wise) in Column C.

No.	Column A	Column B	Column C
1.	Gunpowder	Sulphur dioxide	Sulphur Dioxide
2.	Marble	Fermi	Calcium Carbonate
3.	Ozone	Aqua regia	Dobson Unit

4.	Argon	Beta- Particle	Blue purple light
5.	Quartz	Frequency	Silicon Dioxide
6.	Mirage	Calcium Carbonate	Total Internal Reflection
7.	Gold	Dobson Units	Aqua Regia
8.	Modulation	Silicon dioxide	Frequency
9.	Length	Total internal reflection	Fermi
10.	Solar Energy	Blue purple light	Beta Particle

Q. 15. Choose the best choice in the following statements.

(1) **Select the correct association:**
(a) **Oxidation-Loss of an electron**
(b) Oxidation-gain of an electron (c) Reduction-gain of a neutron
(d) Reduction-loss of a neutron

(2) **Radioactive isotope of Uranium used in Nuclear Bomb is:**
(a) $_{92}U^{235}$ (b) $_{92}U^{234}$
(c) $_{92}U^{233}$ (d) $_{92}U^{238}$

(3) **Human population growth is greatest in developing countries because:**
(a) **The birth rate is high in developing countries**
(b) The death rate is high in developing countries.
(c) Much of the population has already reached the child bearing age.
(d) Most of the world's population lives in industrialized countries.

(4) **Which woody raw material is used for the manufacture of paper pulp?**
(a) Cotton (b) **Poplar**
(c) Bagasse (d) Rice straw

(5) **Rectified spirit contains alcohol about:**
(a) 80% (b) **95%**
(c) 70% (d) 85%

(6) **Which of the following elements is not present abundantly in earth's crust:**
(a) Silicon (b) **Radium**
(c) Aluminum (d) Carbon

(7) **The famous book; Al-Qanun was written by the Muslim scientist:**
(a) Jabar bin Hayyan (b) Zakariya Al-Razi
(c) **Abu Ali Sina** (d) Abdul Qasim Majreeti

(8) **Basic metals can be converted into gold by:**
(a) Heating (b) Beating
(c) **Artificial nuclear radioactivity** (d) Chemical reaction

(9) **A light year is a unit of:**
(a) Time (b) Energy
(c) **Length** (d) Mass

(10) **One of the main functions of the earth's ozone layer is to:**
(a) Prevent global warming (b) **Filter out ultraviolet rays**
(c) Absorb pollution (d) All of the above

EVERYDAY SCIENCE 2006

Q.1. Write short notes on only TWO of the following: (5 each)

(a) Magnetic Resonance Imaging: Magnetic resonance imaging (MRI), or **nuclear magnetic resonance imaging (NMRI)**, is primarily a noninvasive medical imaging technique used in radiology to visualize detailed internal structure and limited function of the body. MRI provides much greater contrast between the different soft tissues of the body than computed tomography (CT) does, making it especially useful in neurological (brain), musculoskeletal, cardiovascular, and oncological (cancer) imaging.

Rather, it uses a powerful magnetic field to align the nuclear magnetization of (usually) hydrogen atoms in water in the body. Radio frequency (RF) fields are used to systematically alter the alignment of this magnetization. This causes the hydrogen nuclei to produce a rotating magnetic field detectable by the scanner. This signal can be manipulated by additional magnetic fields to build up enough information to construct an image of the body.

(b) Tidal Energy: Tidal power, also called **tidal energy**, is a form of hydropower that converts the energy of tides into electricity or other useful forms of power. The first large scale tidal power plant (the Rance Tidal Power Station) started operation in 1966.

Tidal power is the only form of energy which derives directly from the relative motions of the Earth–Moon system, and to a lesser extent from the Earth–Sun system. The tidal forces produced by the Moon and Sun, in combination with Earth's rotation, are responsible for the generation of the tides. Other sources of energy originate directly or indirectly from the Sun, including fossil fuels, conventional hydroelectric, wind, biofuels, wave power and solar. Nuclear energy is derived using radioactive material from the Earth, geothermal power uses the Earth's internal heat which comes from a combination of residual heat from planetary accretion (about 20%) and heat produced through radioactive decay (80%)

(c) Supersonics: The term **supersonic** is used to define a speed that is over the speed of sound. In dry air at 20 °C (68 F, the threshold value required for an object to be traveling at a supersonic speed is approximately 343 m/s, (1,125 ft/s, 768 mph or 1,236 km/(h) Speeds greater than 5 times the speed of sound (Mach 5) are often referred to as hypersonic.

Q. 2. What is Pollen Allergy? What preventive measures are to be taken to avoid it? (4, 6)

Ans.

Pollen Allergy Each spring, summer, and fall, tiny particles are released from trees, weeds, and grasses. These particles, known as pollen, hitch rides on currents of air. Although their mission is to fertilize parts of other plants, many never reach their targets. Instead, they enter human noses and throats, triggering a type of seasonal allergic rhinitis called pollen allergy, which many people know as hay fever or rose fever (depending on the season in which the symptoms occur) Of all the things that can cause an allergy, pollen is one of the most widespread. Many of the foods, drugs, or animals that cause allergies can be avoided to a great extent; even insects and household dust are escapable. Short of staying indoors when the pollen count is high and even that may not help there is no easy way to evade windborne pollen.

There's no proven way to avoid getting hay fever in the first place. However, doctors think reducing a child's exposure to allergy-causing substances such as dust mites may help delay or prevent hay fever — but the evidence isn't clear yet.

If you have hay fever, the best thing you can do is to take steps to lessen your exposure to the allergens that cause your symptoms. Take allergy medications before you're exposed to allergens, as directed by your doctor. If you know you're going to be exposed to hay fever triggers, start taking your medication before your symptoms start, if your doctor recommends it.

Q. 3. Name. (1 each)

Ans. (1) The alloy consisting of metals copper, zinc and nickel. **(German silver)**

(2) The instrument specially designed for recording earthquake waves. **(Seismograph)**

(3) The electrical device which converts sound energy into electrical energy. **(Microphone)**

(4) The ore of mercury metal. **(Cinnabar)**

(5) The device with which variation of blood flow can be heard. **(Sphygmomanometer) (stethoscope)**

(6) The element, which is abundantly present in the human body. **(Hydrogen)**

(7) The scientist who discovered penicillin. **(Sir Alexander Fleming.**

(8) The astronaut who first landed on the surface of the moon. **(Neil Armstrong)**

(9) The desert mammal, which does not drink water. **(Camel)**

(10) The mode of heat transfer from the sun to the earth. **(Radiation)**

Q. 4. Write briefly (not more than four to five sentences) about only FIVE of the following: (2 each)

(a) **Plaster of Paris:** it is a compound of Calcium. When hydrated, the form is rigid. It is a Blessing for broken bones. It is also used for architecture designing (Model designing). Sculptures and for filling purposes in different areas.

(b) **Theodolite: se past paper**

(c) **Bird Flu:** it is a viral disease of birds. It is not only effective in birds, but generally is, some viruses have a strong tendency for mutations. People who work at poultry farms and shops should be inoculated.

(d) **Gene:**

(See Ch. 2, portion of Genes)

(e) **Thermistor:** A type of an electrical device. A semiconductor, which regulates the current flow under the influence of heat. It is used in sensitive heat measuring/operative devices e.g. thermocouples

(f) **Thermostat:** Thermo = Heat, Stat = Statically stable

It is a thermo-electrical device. It works on the principle of thermal expansion. It is used as a temperature regulator in home appliances like refrigerators, ac, and iron.

(g) **Pedometer:** A pedometer or step counter is a device, in modern times usually portable and electronic or electromechanical, that counts each step a person takes by detecting the motion of the person's hips. Because the distance of each person's step varies, an informal calibration performed by the user is required if a standardized distance (such as in kilometres or miles) is desired.

Q. 5. Which physical quantities are measured by the following units? (1 each)

(a) Foot-Pound **(Energy)**
(b) Torr **(Pressure)**
(c) Slug **(Mass)**
(d) Guass **(Magnetism)**
(e) Acre Foot **(Volume of water)**
(f) Becquerel **(radioactivity)**
(g) Erg **(force)**
(h) Dyne **(Force)**
(i) Gilbert **(Magneto motive force)**
(j) Dioptre **(Lens optical power)**

Q. 6. What is the difference between Dam and Barrage? What benefits are obtained by constructing a big dam? (2, 8)

Ans. (See solved paper 1993)

Benefits of Dams:

Leverage to agriculture, by making use of the rain water also.

Ensures regulated flow in the streams. So is an agricultural blessing.

Electricity Production is cheaper for a big dam.

By the construction of big dams, we get an employment channel for our talented Pakistanis.

Q. 7. Which of the following statements are True and which are False: (1 each)

(1) Pitch of the dog sound is greater than the pitch of the cat sound. **(False)**

(2) Ultraviolet light is visible but infrared light is not visible. **(False)**

(3) Earthquakes are the lamps illuminating the structure of the earth's exterior. **(False)**

(4) Electricity does not move through the wire but through a field around the wire. **(False)**

(5) A guava contains more vitamin C than an orange. **(True)**

(6) Sound travels faster in iron than in air. **(True)**

(7) Wheat stone Bridge is the name of an electrical circuit. **(True)**

(8) Morphine can cause constipation and lowering of blood pressure. **(True)**

(9) A concave lens is used for the correction of the Hyperphobia. **(False)**

(10) The nucleic acids are responsible for proteins synthesis in the human body. **(True)**

Q. 8. Differentiate between the following pairs: (2 each)

(a) Telemeter and Multimeter: Telemeter is used to convey the physical statistics to a distance, while a multimeter is a complex device, having a potentiometer and ammeter.

(b) Perimeter and Altimeter: Perimeter is a conceptual term, while the altimeter is a device, for measuring the altitudes.

(c) Periscope and Microscope: In microscope, the channel of light waves is straight, while in a periscope, it is bended by the use of a mirror o a prism.

(d) Nucleon and Photo: Nucleon is a sub-nuclear particle, while a photon is an energy packet.

[redacted]

(e) Cusec and Comet: Cusec is a measure of flow, while comet is a mass of ice and dust with a long tail, moving around the solar system.

Q. 9. Fill in the blanks: (1 each)

(1) The branch of zoology, which deals with the study of insects is called **entomology.**

(2) The disease **beriberi** is caused by the deficiency of Vitamin B1 (Thiamine)

(3) Oil rises in a wick of oil lamp because of a property of matter, called **capillary action.**

(4) The production of generally identical reproduction is called as **Cloning.**

(5) **Pluto** is the farthest planet of the solar system.

(6) Mercury metal is **13.5** times heavier than water.

(7) Relative density of milk is measured by an instrument known as **lactometer.**

(8) The temperature of a human body is measured by an instrument known as **thermometer**.

(9) Gold and silver are known as **coinage metals.**

10) The amount of ozone in the atmosphere is expressed in **ppm.**

Q.11. Give scientific reasons of the following: (2 each)

(a) Why do some people snore? In unconscious sleep, the tongue droops back due to muscular relaxation. The tongue comes in the way of whir channel and flutters and hits the pallet.

(b) Why do we sometimes sleep walk?

1. Sometimes our unconscious mind takes over.
2. The unconscious is derived by the conscious, that's why we have fewer accidents.

(c) Climber bends forward while climbing a mountain.

1. Drops his weight forward and uses the gravity effect to get a pull forwards.
2. The weight on the limbs is also lessened, so they get tired a little late then otherwise.

(d) The manhole covers are generally round.

(See solved paper 2004)

(e) Roads are bent inwards on curves.

1 The centrifugal force experienced by the vehicle is lowered by the raised end, so the vehicle doesn't skit or goes off from the road.

2. The centripetal force is supplemented by the gravitational forces from below.

Q. 12. What are vitamins and minerals? Which vitamins and minerals play major role in the development of bones? (4, 6)

Minerals: These are the ground matters, naturally occurring abundantly in the non-livings also. Examples are sodium, potassium, calcium, phosphorous, iron, sulphur and molybdenum etc.

(for details, see the portion of Vitamins, Ch 2)

(for minerals, see Ch. 1)

Q.13. What do the following scientific abbreviations stand for? (1 each)

(1) CRO – **Cathode rays oscillator**
(2) SARS – **Severe Acute respiratory syndrome**
(3) BOT – **Built operate transfer**
(4) AMU – **Atomic mass unit**
(5) EMF – **Electromotive force**
(6) ADH – **Anti diuretic hormone**
(7) STP – **Standard Temperature Pressure**
(8) GEV – **Giga Electron Volt**
(9) NTP – **Normal Temperature Pressure**
(10) CRT – **Cathode ray tube**

Q.14. Compare the columns A and B and write the correct answer from the column B corresponding to the column A (serial wise) in column (C) (1 each)

Answers:

No.	Column A	Column B	Column C
(1)	Geiger Muller Counter	Semi Conductor	(1) Radioactivity
(2)	Newton	Magnet	(2) Gravitation
(3)	Addison	Electricity	(3) Electricity
(4)	Bardeen and Brattin	Radioactivity	(4) Semiconductor
(5)	Weber Fehner's Law	E.M Induction	(5) Non-conductor
(6)	Benjamin Franklin	Lightening Conductor	(6) Lightening Conductor
(7)	Decibel	Gravitation	(7) Sound
(8)	Dr. Gilbert	Water	(8) Magnet
(9)	Henry Cavendish	Sound	(9) Water
(10)	Faraday	Non-conductor	(10) E.M. Induction

Q. 15. Choose the best choice in the following statements:

(1) One of the countries through which equator passes is:

(a) Kenya (b) **Malaysia**
(c) Malta (d) Pakistan

(2) Copper can be converted into gold by:

(a) Artificial radioactivity (b) Heating
(c) Electroplating (d) Chemical reaction

(3) The three elements needed for healthy growth of plants are:

(a) N, P, K (b) N, C, P
(c) N, K, (d) N, S, P

(4) Clocks, which moves with the velocities comparable with the velocity of light, run:

(a) Fast (b) Slow
(c) Equal to the velocity of light **(d) With zero velocity**

[redacted]

(5) Max Planck received the noble prize in Physics in 1918 for his discovery of:

(a) Electron
(b) Energy quanta
(c) Photon
(d) Positron

(6) Bronze medal is made up of metals:

(a) (Copper, nickel)
(b) (copper, tin)
(c) (Copper, silver)
(d) (Copper, zinc)

(7) Addison's disease is caused by the excessive secretion of:

(a) Antidiuretic Hormone
(b) Luteinising Hormone
(c) Melanophore stimulating Hormone
(d) Adrenocorticotrophic Hormone

(8) Development of calf muscles in ladies who wear high heels is a common example of:

(a) Natural Selection
(b) Inheritance of acquired character
(c) Use and disuse of organ
(d) Artificial selection

(9) Margalla Hill is a branch of:

(a) Karakorum range
(b) Hindukash range
(c) Himalaya range
(d) Nanga Parbat range

(10) Humming bird belongs to a category called:

(a) Ectotherm
(b) Endotherm
(c) Exotherm
(d) Heterotherm

EVERYDAY SCIENCE 2007

Q.1. Write short notes on any two of the following (5 each)

(a) Laser (b) Nuclear reactor

(c) Ceramics

Ans. (See chapter 1)

Q. 2. Write briefly (not more than three to four sentences) about any five of the following (2 each)

(a) Asteroids (b) Black Hole

(c) Aurora (d) Sedimentary Rock

(e) Epiphytes (f) Ionosphere

(a) Asteroids: Asteroids, also called minor planets or planetoids, are a class of astronomical objects. The asteroid is a small celestial body that drifts in the solar system in orbit around the Sun, between the orbits of Mars and Jupiter.

(b) Black Hole: black hole is an object with a gravitational field so powerful that even electromagnetic radiation (such as light) cannot escape its pull.

(c) Aurora: The aurora is a bright glow observed in the night sky, usually in the polar zone. For this reason some scientists call it a "polar aurora".

(d) Sedimentary Rock: A Sedimentary rock is one of the three main rock groups (along with igneous and metamorphic rocks) Sedimentary rocks cover 75% of the Earth's land area. Sedimentary rocks include common types such as chalk, limestone, sandstone and shale.

(e) Epiphytes: An epiphyte is an organism that grows upon or attached to a living plant. Epiphytic plants are sometimes called "air plants" because they do not root in soil.

(f) Ionosphere: The ionosphere is the part of the atmosphere that is ionized by solar radiation. It plays an important part in atmospheric electricity and forms the inner edge of the magnetosphere.

Q. 3. Differentiate between the following pairs: (2 each)

(a) BIT and BYTE (See solved paper 1997)

(b) RAM and ROM (See solved paper 1997)

(c) Epidemic and endemic (See solved paper 1995)

(d) Photosynthesis and respiration:

Respiration: It is one of the most important metabolic activities of all organisms, which occurs at two levels: the organism and cellular level. Organismic respiration is also called breathing or ventilation while in cellular respiration cell utilizes oxygen, produces CO_2, extracts and conserves the energy from food molecules by combustion in the form of ATP.

Photosynthesis: It is the reverse of respiration, which involves the synthesis of carbohydrates with the help and water and carbon dioxide in the presence of light and chlorophyll. Photosynthesis is the characteristic feature of autotrophic plants and not found in heterotrophic organisms. Plants use CO_2 and eliminate O_2 into the environment.

(e) Herbivores and carnivores

Herbivores: The animals that depend totally on plants or plant material for their food are called herbivores. Examples include rabbits, squirrels, cattle etc.

Carnivores: The animals that depend on other animals for their food and eat flesh as their food are called as the carnivores. Examples include cat, dog, lion, tiger etc.

Q. 4. (i) **What are the endocrine glands? Name any Two.** **(2+2)**

Ans. (See Ch. 4 portion of endocrine glands)

(ii) **Name the parts of human body from where the following secreted:** **(6)**

(a) Insulin- **Pancreas**
(b) Thyroxin- **thyroid gland**
(c) Adrenalin- **Adrenal Medulla**
(d) Oestrogen- **From ovaries (in females)**
(e) Cortisol- **From adrenal cortex**
(f) Testosterone- **From testis** (in males) and from adrenal cortex in both males and females.

Q. 5. (a) **Briefly discuss the classification of plants giving suitable examples:** **(6)**

Ans. (See Ch. 2, the portion of Plant Kingdom)

(b) Define the following: **(4)**

(1) **Vaccine:** an antigenic preparation used to establish immunity to a disease.
(2) **Antibiotic:** a drug that kills or prevents the growth of bacteria.
(3) **Solar eclipse:** occurs when the Moon passes between Earth and the Sun.
(4) **Exothermic:** A reaction that releases energy in the form of heat is called exothermic.

Q. 6. Give scientific reasons of the following: (2 each)

(a) **Why climbers get their food by climbing on other trees?**

Ans. By climbing on other trees, they get close to the light source.

(b) **Mars is called Red Planet.**

Ans. Mars is a barren desert. It is covered with red dust that is why we call Mars, the Red Planet.

(c) **Vitamin D is the essential component of the Body.**

Ans. Vitamin D is responsible for the absorption of calcium and phosphorus in the bones.

(d) **The weight of the object is less at the Equator than at the Poles.**

Ans. At Equator, the distance from the Earth's center is greater than any other point of the Earth's surface. Since, weight is defined as the force with which a body is attracted towards the Earth's center, so greater the distance, less is the force applied. Hence, the object's weight is lightest at the Earth's equator, than at Poles.

(e) **Why do some people snore?**

Ans. (See solved past paper)

Q. 7. **Give description of satellites and also give their functions.** **(10)**

Ans. (See Ch. 1 portion of Satellites)

Q.8. (a) What is balance diet? (5)

Ans. (See Ch. 4, portion of Balance Diet)

(b) How are characters transmitted from parents to offspring? (5)

Heredity is the passing of traits to offspring (from its parent or ancestors). This is the process by which an offspring cell or organism acquires or becomes predisposed to the characteristics of its parent cell or organism. Through heredity, variations exhibited by individuals can accumulate and cause a species to evolve. The study of heredity in biology is called genetics, which includes the field of epigenetics.

Various hereditary mechanisms were envisaged without being properly tested or quantified. These included blending inheritance and the inheritance of acquired traits. Nevertheless, people were able to develop domestic breeds of animals as well as crops through artificial selection. The inheritance of acquired traits also formed a part of early Lamarckian ideas on evolution.

EVERYDAY SCIENCE 2008

PART-II (SUBJECTIVE)

Time Allowed: 100 minutes Maximum Marks: 50

Note: (i) Attempt ONLY FIVE questions. All questions carry EQUAL marks. (ii) Extra attempt of any question or any part of the attempted question will not be considered.

Q.1. **Write briefly about the life and scientific contributions of the following Muslim Scientists: (5+5)**

(a) Muhammad bin Musa Al-Khawarizmi

(b) Abu Ali Sina

Ans. (See Appendices)

Q. 2. **Differentiate clearly between the following pairs: (2 each)**

(a) Fission and Fusion:

Ans. (See solved paper 1996)

(b) Star and Planet:

Ans. (See solved paper 1996)

(b) Fertilization & Pollination:

Ans. (See solved paper 1995)

(c) Telescope & Microscope:

Ans. **A telescope** is an instrument designed for the observation of remote objects by the collection of electromagnetic radiation.

A microscope is an instrument for viewing objects that are too small to be seen by the naked or unaided eye.

(d) Antibiotics & Vaccination:

An antibiotic is a substance or compound that kills or inhibits the growth of bacteria. Antibiotics belong to the group of antimicrobial compounds used to treat infections caused by microorganisms, including fungi and protozoa.

Vaccination is the administration of antigenic material to produce immunity to a disease. Vaccines can prevent or ameliorate the effects of infection by a pathogen. It is considered to be the most effective and cost-effective method of preventing infectious diseases.

Q. 3. **(a) Discuss briefly the SOLAR SYSTEM. (6)**

Ans. (See Ch. 1, portion of Solar System)

(b) How are Earthquakes caused? (4)

Ans. (See Ch. 1, portion of Earthquakes)

Q. 4. **Write briefly (not more than four to five sentences) about any FIVE of the following: (2 each)**

(a) Supernova: star increasing suddenly in brightness.

(b) Radioactivity: radioactivity is the spontaneous emission of radiations from the radioactive elements like uranium, radium, thorium etc. three types of rays are emitted during radioactivity, called, alpha rays, beta and gamma rays. Alpha rays carry positive, beta carry negative while gamma rays carry no charge.

(c) Laser:

Ans. (See Ch. 1, portion of Laser)

(d) Semiconductors:

Ans. (See Ch. 1, portion of Semi-Conductors)

(e) Geothermal Energy: Geothermal power is power extracted from heat stored in the earth. This geothermal energy originates from the original formation of the planet, from radioactive decay of minerals, and from solar energy absorbed at the surface.

(f) Computer Virus: self-replicating code maliciously introduced into a computer program and intended to corrupt the system or destroy data.

(g) Pasteurization: it is a process in which milk is heated at 72.5 celsius for 15 seconds to kill microorganisms in it.

Q.5. (a) What are HORMONES? Name four important hormones and describe their functions in the human body. (2+4)

Ans. (See Ch. 2, portion of Hormones)

(b) Explain the structure and function of an ANIMAL CELL with a labeled diagram. (2+2)

Ans. (See solved paper 1994)

Q. 6. (a) What are the essential nutrients of BALANCED DIET? Describe one such nutrient in detail explaining its role in the metabolism. (2+4)

Ans. (See Ch. 5, portion of Balance Diet)

(b) What do the following scientific abbreviations stand for? (1/2 each)

(i) **PVC** - Polyvinyl Chloride
(ii) **BCG** - Bacillus Calmette Guérin.
(iii) **ECG** - Electrocardiogram.
(iv) **CFC** - Chlorofluorocarbon
(v) **LPG** - Liquefied Petroleum Gas
(vi) **DNA** - Deoxyribonucleic acid
(vii) **AIDS** - Acquired Immune Deficiency Syndrome
(viii) **TNT** - Trinitrotoluene
(ix) **EEG** – Electroencephalogram

Q. 7. (a) Define ENERGY. Name four renewable sources of energy. How can our country come out of Energy Crisis? (1+2+3)

Ans. (See Ch. 1, Introduction)

Renewable sources of Energy:

- Biomass - including wood and wood waste, municipal solid waste, landfill and biogas, ethanol, and biodiesel
- Water (hydropower)
- Geothermal
- Wind
- Solar

Recommendations to overcome Energy Crisis:

— New power generation and conservation projects.
— Replacement of inefficient plants.
— Reducing transmission and distribution loss.
— Construction of new Dams.
— Institutional and Administrative Improvement.
— Utilization of largest deposits of coal.
— Renewable sources of energy.
— Public Awareness.

(b) Write a brief note on CERAMICS. **(4)**

Ans. (See Ch. 1, portion of Ceramics)

Q. 8. (a) Describe very briefly the working of a CAMERA. How does it resemble in its function with that of the HUMAN EYE? (3+3)

Ans. (See Ch. 1, portions of Camera and Camera Vs Eye)

(b) What are PLASTCS? Describe briefly their characteristics and Limitations. (1+3)

Ans. (See Ch. 1, portion of plastics)

Part - I (OBJECTIVE PORTION)

Note: Candidates were not allowed to take away the Question Paper of MCQs portion. The following MCQs are recalled by members of CSS Forum.

1. Japan is called:
(a) Land of earthquakes
(b) Land of rising sun
(c) Land of rivers

2. Which of the following is used to kill rats?
Ans. Rodenticides

3. Which planet of our solar system is called as Morning star?
Ans. Venus

4. What is the diameter of the earth?
Ans. 12756.2 kilometers

5. Opium is found in?
Ans. Drug made from the juice of a certain poppy, used aspirin, as an analgesic and narcotic.

6. Opium is used to make the following:
Ans. Heroine

7. Which one of the following book was written by Ibn-al-Haitam?
Ans. Speed of light is?
386000 km/sec

8. Which of the following energy in converted into electric in a generator?
(a) Chemical (b) **Mechanical**

(c) Thermal

9. **Diamond is the refined form of**

(a) Carbon (b) Coal

10. **Dry Ice is?**

Ans. Solidified CO_2

11. **Telephone was invented by?**

Ans. Alexander Graham Bell

12. **Name the instrument used to measure electric current?**

Ans. Ammeter

13. **Ascorbic is vitamin?**

Ans. A, B, C, K

14. **Total number of bones in human face is?**

Name of vitamin C:

Ans. Ascorbic Acid

15. **The sky appears blue due to:**

Ans. Tindal effect

16. **Fat soluble vitamins:**

A, D, E, K

17. Mixture used for welding - **Chemical composition**

18. Which of the following is not a thermoplastic?

Ans. **Bakelite**

19. Hematite (a mineral) is the important source of? **Iron**

20. Fat soluble vitamins are?

A, D, E and K.

21. Bauxite is the mineral of?

Ans. **Aluminium.**

22. Abu Ali Sina, Al Biruni, Ibn Al Haitham belonged to which century - **10th century**

23. Bakelite, Polyester are which type of plastics - **Thermosetting plastics**

24. Bronze is an alloy of - **Copper and tin**

25. Which of the following is an invertebrate – **Insects**

26. identify the animal – rudimentary wings, long bill, lives in burrows – **Kiwi**

27. Largest organ of human body – **Skin**

28. Vaccine for T.B- **Bacillus Calmette Guarene** (BCG)

29. Power house of cell – **Mitochondria.**

EVERYDAY SCIENCE 2009

TIME ALLOWED:
(PART I) 80 MINUTES MAXIMUM MARKS: 50
(PART II) MINUTES MAXIMUM MARKS: 50

Note: (i) First attempt PART I (MCQ) on separate Answer Sheet which shall be taken back after 80 minutes.

(ii) Overwriting/cutting of the options/answers will not be given credit.

PART – I (MCQs)
(COMPULSORY)

Q.1. Select the best option/answer and fill in the appropriate Box on the Answer Sheet: **(50)**

(1) Person with following blood group are considered to be universal recipient.

(a) A+
(b) B+
(c) AB+
(d) O+
(e) None of these

The AB^- group is considered to be universal recipient

(2) Study of life in outer space is known as:

(a) Endo-biology
(b) Exobiology
(c) Entero-biology
(d) Neo-biology
(e) Micro biology

(3) The name of the common mineral salt present in sweat is:

(a) Calcium Oxalate
(b) Potassium Sulphate
(c) Sodium Chloride
(d) Iron Sulphate
(e) None of these

(4) Sensitive layer of the eye is:

(a) Choriods
(b) Sclerotic
(c) Retina
(d) Cornea
(e) None of these

(5) Laughing gas has chemical composition of following two elements.

(a) Nitrogen + Hydrogen
(b) Nitrogen + Carbon
(c) Nitrogen + Oxygen
(d) Oxygen + Carbon
(e) None of these

(6) Dr. Abdus Salam of Pakistan was one of the contributors of the unification of:

(a) Electromagnetic force and gravitational force
(b) Electromagnetic force and weak nuclear force
(c) Gravitational force and weak nuclear force
(d) Weak nuclear force and strong nuclear force

(e) None of these

(7) Which triplet in DNA codes for valine:

(a) CTT (b) AGU

(c) CAT (d) AAT

(e) None of these

(8) What is the chance of diabetic baby born to parents both heterozygous normal?

(a) Zero **(b) ¼**

(c) ½ (d) ¾

(e) None of these

(9) Which of the following is not a part of Darwinism:

(a) Over production (b) Natural selection

(c) Inheritance for acquired characters

(d) Competition for survival (e) None of these

(10) Role of biotechnology in the production of food based on:

(a) Decomposition (b) Respiration

(c) Digestion **(d) Fermentation**

(e) None of these

(11) Which form of drug abuse involves most risk of infection with the HIV (AIDS) virus?

(a) Cigarette smoking (b) Using alcholo

(c) Injection of heroine (d) Taking too much aspirin

(e) None of these

(12) Founder of modern astronomy was:

(a) Archimedes (b) William Gilbert

(c) Nicolas Copernicus (d) Michael Faraday

(e) None of these

(13) The instrument which measures very high temperature is:

(a) Manometer (b) Thermostat

(c) Chronometer **(d) Pyrometer**

(e) None of these

(14) The science which deals with study of manners and customs of people is:

(a) Ethnology (branch of anthropology)

(b) Morphology (c) Ethics

(d) Genetics (e) None of these

(15) Chemical used to kill rats and mice are:

(a) Insecticides **(b) Rodenticides**

(c) Fungicides (d) Herbicides

(e) None of these

(16) Dry ice is:

(a) Methane hydrate (b) Liquid Nitrogen

(c) **Solid Carbon dioxide**
(d) Frozen Water
(e) None of these

(17) Chemical name of vinegar is:
(a) Sodium Nitrate
(b) **Dilute acetic acid**
(c) Chloride of lime
(d) Calcium
(e) None of these

(18) Deficiency of following vitamin decreases hemoglobin production
(a) Biotin
(b) Thiamine
(c) Niacin
(d) **Pyridoxine**
(e) None of these

(19) Hygrometer is used for measuring the:
(a) Speed of sound
(b) Density of milk
(c) **Humidity of air**
(d) Specific gravity of liquids
(e) None of these

(20) Bronze is an alloy of:
(a) Copper and Zinc
(b) Tin and Zinc
(c) **Copper and Tin**
(d) Iron and Zinc
(e) None of these

(21) Which of the following is most elastic?
(a) **Steel**
(b) Rubber
(c) Glass
(d) Sponge
(e) None of these

(22) Orbital period of the planet Mercury around the sun is:
(a) **88 days**
(b) 365 days
(c) 2 years
(d) 98 days
(e) None of these

(23) The most splendid and the most magnificent constellation on the sky is:
(a) **Orion**
(b) Columbia
(c) Canis Major
(d) Taurus
(e) None of these

(24) "Black holes" refer to:
(a) Hole occurring in heavenly bodies
(b) Bright spots on the sun
(c) **Collapsing objects of high density**
(d) Collapsing of low density
(e) None of these

(25) Eugenics is the study of:
(a) **Altering human beings by changing their genetic components** (close to the actual definition)
(b) People of European region
(c) Different races of mankind
(d) Genetic of plants
(e) None of these

Eugenics: study of the possibility of racial improvement through selective breeding and other methods

(26) The position of Earth in its orbit, when it is at its greatest distance from the Sun causing northern summer is called:
(a) **Aphelion**
(b) Perihelion
(c) Perigee
(d) Apogee
(e) None of these

(27) Diamond is a very expensive ornament. It is composed of a single element:
(a) **Carbon**
(b) Gold
(c) Silver
(d) Platinum
(e) None of these

(28) Which of the following layers make radio transmission possible?
(a) Troposphere
(b) **Ionosphere**
(c) Mesosphere
(d) Stratosphere
(e) None of these

(29) Which of the following explains the reason why there is no total eclipse of the Sun?
(a) Size of the Earth in relation to that of Moon
(b) Orbit of moon around Earth
(c) Direction of rotation of Earth around Sun
(d) **Area of the Sun covered by the Moon**
(e) None of these

(30) Television signals are converted into light signals by:
(a) Optical fiber
(b) Transistor
(c) Decoder
(d) **Photo diode**
(e) None of these

(31) Where do most of Asteroids lie?
(a) **In asteroid belt between the orbits of Mars and Jupiter**
(b) In asteroid belt between the orbits of Mars and Venus
(c) In asteroid belt between the orbits of Jupiter and Venus
(d) Everywhere in the sky
(e) None of these

(32) The number of spark plugs needed in a diesel engine is:
(a) 2
(b) 3
(c) **0**
(d) 4
(e) None of these

(33) The half-life of a radioactive element is 8-days. How long it take to reduce it from 10 mg to 5 mg?
(a) 4 days
(b) 12 days
(c) 16 days
(d) **8 days**
(e) None of these

(34) **The term 'Blue Shift' is used to indicate:**

(a) **Doppler effect in which an object appears bluer when it is moving towards the observer or observer is moving towards the object.**

(b) Turning a star from white to blue

(c) In future Sun would become blue

(d) Black hole was blue at its start

(e) None of these

The opposite is the famous red shift which indicated the universe is expanding away from us.

(35) **Kilowatt-hour is a unit of:**

(a) Power (b) Electric Current

(c) **Energy** (d) Time

(e) None of these

(36) **Fuel used in a Fast Breeder Reactor is:**

(a) Uranium Oxide (b) Uranium Plutonium carbide

(c) **Uranium Plutonium Oxide** (d) Uranium thorium Oxide

(e) None of these

(37) **Monsoon is caused by:**

(a) **Seasonal reversal of winds**

(b) Revolution of Earth (c) Movement of clouds

(d) Rise in temperature (e) Rain forests

(38) **Which of the following atmospheric layers help in radio communication?**

(a) Exosphere (b) **Ionosphere**

(c) Troposphere (d) Stratosphere

(e) Ozone layer

(39) **A moderator is used in nuclear reactor in order to:**

(a) Accelerate the neutrons

(b) **Slow down the speed of the neutrons**

(c) Increase the number of elections (d) Decrease the number of electrons

(e) None of these

(40) **Sedimentary rocks are:**

(a) **Porous** (b) Hard

(c) Rough (d) Brittle

(e) Volcanic

(41) **Which one of the following is a non-metallic mineral?**

(a) Manganese (b) Magnesium

(c) **Gypsum** (d) Bauxite

(e) None of these

(42) **Ozone layer prevents the following radiation from entering the atmosphere:**

(a) Infra-red (b) **Ultraviolet**

(c) X-rays (d) Gamma rays

(e) None of these

(43) The phenomenon of Aurora Borealis, the display of red and green lights in northern hemisphere is due to radiations from:

(a) Ionosphere (b) Troposphere
(c) Mesosphere (d) Stratosphere
(e) None of these

(44) Yeast is used in making bread because it produces:

(a) Carbon dioxide (b) Sugar
(c) Bacteria (d) Oxygen
(e) None of these

(45) Oasis is associated with:

(a) Glaciers **(b) Desert**
(c) Islands (d) Volcanoes
(e) Fertile land

(46) Quartz crystal in quartz watches work on the principle called:

(a) Photoelectric effect (b) Stark effect
(c) Thermionic effect **(d) Piezo-electric effect**
(e) None of these

Piezo-electric effect

Electric polarization produced in certain crystals by the application of mechanical stress.

(47) The fruits without seed, like banana, are called:

(a) Seedless fruits (b) Parthenogenesis fruits
(c) Parthenocarpic fruits (d) Placental fruits
(e) Organic fruits

(48) Animal which captures and readily kills living animals for its food is called:

(a) Parasite (b) Scavenger
(c) Predator (d) Mammal
(e) None of these

(49) In a railway track, two rails are joined end to end with a gap tin between them because:

(a) Steel can be saved
(b) Accidents due to contraction in winter can be avoided
(c) Air gaps are necessary for bearing the weight of running train
(d) Accidents due to expansion in summer can be avoided
(e) All of these

(50) Name the famous book of Ibn-Sina in which he discussed human physiology and medicine:

(a) Al-Qanoon (b) Al-Masudi
(c) New Renaissance (d) Tadhkira
(e) None of these

PART – II (Subjective)

Q.2. **Write short note on the following by giving their exact life span and contribution to the field of science (Accurate facts will be appreciated.**

(a) Umer Al-Khayam (b) Zakariya Al-Razi **(5×2)**

Ans. (See Appendices)

Q. 3. Differentiate between ANY FIVE of the following pairs. **(2×5)**

(a) Umbra and Penumbra:

Umbra – area of the shadow of an eclipse, dark center of a sunspot.

Penumbra - partly lighted area around any shadow

(b) Heavy water and hard water:

Heavy Water – water with a higher average molecular weight than ordinary water, water used for cooling the core of an atomic reactor.

Hard Water – water containing a high concentration of minerals and calcium.

(c) Smog and Smoke:

Smog – mixture of smoke and fog.

Smoke – visible vapor given off by burning material.

(d) Myopia and Hypropia:

Myopia – nearsightedness, condition of the eyes in which objects that are far away cannot be seen clearly (Ophthalmology); lack of insight and forethought.

Hyperopia – far-sightedness, ability to see distant objects more clearly than near ones.

(e) Lava and Magma:

Lava – molten rock expelled from a volcano; solidified volcanic rock.

Magma – molten rock beneath the Earth's crust from which igneous rocks are formed (Geology).

(f) Periscope and perimeter:

Periscope – optical scope that allows one to see objects that are located above one's line of sight.

Perimeter – outer boundary of a figure or area; total length of the outer boundary.

(g) X-rays and Gamma rays:

X-Rays – High energy electromagnetic radiation of wavelengths in the range 10 to 0.1 nanometres. X-rays are extra-nuclear and have two sources: (1) A characteristic (e.g. K- or L-) X-ray photon is created and emitted when an electron drops down orbits to fill a vacancy in an innermost shell.

(2) A bremsstrahlung photon is produced when a high speed positive or negative electron decelerates when passing through the electric field in the close vicinity of an atomic nucleus

Gamma Rays - The wavelength of gamma rays is typically less than 10-12 metres. They differ from X-rays in that they originate in the nucleus of atoms. A gamma ray is a photon, i.e. a discrete packet of many waves

[redacted]

Q. 4. **Sun is glorious star in our sky. Write down its characteristics with reference to the following date:**

(a) **Distance from Earth:**

Ans. 149,600,000 kilometers, or 92,960,000 miles.

(b) **Mean distance from center of galaxy:**

Ans. 26,000 light-years.

(c) **Velocity around centre of galaxy:**

Ans. 251 km/s.

(d) **Revolution period around centre of galaxy:**

Ans. 225–250 million years (one Galactic year).

(e) **Equatorial diameter:**

Ans. 6.955×10^8 m.

(f) **Rotation period at the equator:**

Ans. 25.05 days.

(g) **Core temperature:**

Ans. 15.7×10^6 K.

(h) **Solar wind:**

Ans. A steady stream of charged particles that boil off the Sun's outer atmosphere and which stream away along magnetic field lines which lead into the interplanetary medium. It is composed of charged particles such as protons, electrons and helium nuclei.

(i) **The lovely Diamond Ring effect:**

Ans. large gush of light that shows up a few seconds before and after totality during a solar eclipse (caused by the last bit of sunlight that shines through valleys on the edge of the moon).

(j) **Future of Sun:**

Ans. The Sun does not have enough mass to explode as a supernova. Instead, in about 5 billion years, it will enter a red giant phase, its outer layers expanding as the hydrogen fuel in the core is consumed and the core contracts and heats up. Helium fusion will begin when the core temperature reaches around 100 million Kelvin and will produce carbon, entering the asymptotic giant branch phase

Q. 5. **Write briefly (not more than three to four sentences) about ANY FIVE of the following:**

(2×5)

(a) **Allotropy:**

Ans. Existence of a chemical element in two or more different forms

For example, the element carbon has two common allotropes: diamond and graphite.

(b) **Nebula:**

Ans. An interstellar cloud of dust, hydrogen gas and plasma. It is the first stage of a star's cycle. Originally *nebula* was a general name for any extended astronomical object, including galaxies beyond the Milky Way (some examples of the older usage survive; for example, the Andromeda Galaxy was referred to as the *Andromeda*

Nebula before galaxies were discovered by Edwin Hubble) Nebulae often form star-forming regions, such as in the Eagle Nebula

(c) Enrichment of Uranium:

Ans. Enrichment of Uranium corresponds to percent composition of uranium-235 being increased through the process of isotope separation. *Natural* uranium is 99.284% U-238 isotope, with U-235 only constituting about 0.711 % of its weight. However, U-235 is the only isotope existing in nature (in any appreciable amount) that is fissionable by thermal neutrons.

(d) Aqua Regia:

Ans. Aqua regia is formed by freshly mixing concentrated nitric acid and concentrated hydrochloric acid, usually in a volumetric ratio of one to three respectively. It is one of the few reagents that dissolve gold and platinum.

(e) Greenhouse effect:

Ans. The effect produced as greenhouse gases allow incoming solar radiation to pass through the Earth's atmosphere, but prevent part of the outgoing infrared radiation from the Earth's surface and lower atmosphere from escaping into outer space. This process occurs naturally and has kept the Earth's temperature about 59 degrees F warmer than it would otherwise b(e) Current life on Earth could not be sustained without the natural greenhouse effect.

(f) **Igneous rocks:** rocks formed by solidification of cooled magma (molten rock), with or without crystallization, either below the surface as intrusive (plutonic) rocks or on the surface as extrusive (volcanic) rocks. This magma can be derived from partial melts of pre-existing rocks in either the Earth's mantle or crust. Typically, the melting is caused by one or more of the following processes — an increase in temperature, a decrease in pressure, or a change in composition. Over 700 types of igneous rocks have been described, most of them formed beneath the surface of the Earth's crust.

Q. 6. (a) Define GENETIC ENGINEERING. In how many ways Genetic Engineering can be applied in different fields of life? Does it benefit society? Discuss. (1+3+2)

Ans. (See Ch. 2, portion of Genetic Engineering).

(b) What do the following abbreviations stand for? (1/2 each)

(i) **SONAR:** SOund NAvigation and Ranging

(ii) **CNS:**Central Nervous System

(iii) **PTFE:**Poly Tetra Fluoro Ethylene.

(iv) **LDL:**Low-Density Lipoprotein.

(v) **SARS:**Severe Acute Respiratory Syndrome

(vi) **GUT:**Grand Unified Theory

(vii) **BASIC:** Beginner's All Purpose Symbolic Instruction Code

(viii) **BTU:**British Thermal Unit

Q. 7. (a) What are MINERALS? Discuss ANY TWO physical properties thereof. Also mention the names of four precious minerals of high commercial value.

Ans. (See Ch. 1, portion of Minerals).

(b) Define the following: (1 each).

(a) Amphibian: cold-blooded vertebrate animal able to live both on land and water.

(b) Synchronous satellite: A satellite in a synchronous orbit.

A synchronous orbit is one in which an orbiting object has a period equal to the average rotational period of the body being orbited.

(c) Big Dipper: group of seven stars.

(d) Fermentation: chemical conversion of organic compounds by means of enzymes. I is of two types: alcoholic fermentation and lactic acid fermentation.

(e) Millennium Bug: an inability in older computing software to deal correctly with dates of 1 January 2000 or later.

Q. 8. (a) Define RECEPTORS in man. Name different receptor organs in huma body. Also discuss ANY TWO of them briefly.

Ans. In a sensory system, a sensory receptor is a sensory nerve ending that recognizes stimulus in the internal or external environment of an organism.

Following are the different sensory receptors:

- Baroreceptors respond to pressure.
- Chemoreceptors respond to chemical stimuli.
- Hydroreceptors respond to changes in humidity.
- Mechanoreceptors respond to mechanical stress or mechanical strain.
- Nociceptors respond to damage to body tissues leading to pain perception.
- Osmoreceptors respond to the osmolarity of fluids (such as in the hypothalamus).
- Photoreceptors respond to light.
- Proprioceptors provide the sense of position.
- Thermoreceptors respond to temperature, either heat, cold or both.
- Electromagnetic Receptors's respond to electromagnetic waves.

(b) Give Scientific reasons of the following: (1 each)

Ans. (i) The dogs pant, the birds open their mouth and the elephants move rapidl their ears.

They use the above-mentioned mechanisms to cool themselves

(ii) The manholes covers are generally round.

Ans. (See solved paper 2004)

(iii) A geo-stationary satellite appears standstill to a viewer on the equator of Earth.

Ans. Because these satellites are in the geo-synchronous orbit (an orbit around the Eart with an orbital period matching the Earth's sidereal rotation period.

Geo-stationary orbit is a type of geo-synchronous orbit that is directly above th equator.

(iv) We never see birds urinating.

Ans. (See solved paper 2005)

(v) Pasteurized milk has more nourishment than the ordinary boiled milk.

Ans. (See solved paper 2005)

Q. 9. (a) Highlight the similarities and differences between animals and plants. (3+3)

Ans. (See Ch. 2, Animal Vs Plant)

(b) Write short note on ANY TWO of the following: (2 each)

(i) Tele-printer: A tele-printer is an obsolete electromechanical typewriter that can be used to communicate typed messages from point to point and point to multipoint over a variety of communication channels that range from a simple electrical connection, such as a pair of wires, to the use of radio and microwave as a transmission medium. They could also serve as a command line user interface to early mainframes and minicomputers, sending typed data to the computer with or without print output, and printing the response from the computer.

(ii) Dengue Virus:

Ans. (See Ch. 2)

(iii) Vacuum Cleaner: it is a device that uses an air pump to create a partial vacuum to suck up dust and dirt, usually from floors. The dirt is collected either a dust bag or a cyclone for later disposal. A vacuum suction is caused by a difference in air pressure. An electric fan reduces the pressure inside the machine. Atmospheric pressure then pushes the air through the carpet into the nozzle, and so the dust is literally pushed into the bag.

EVERYDAY SCIENCE 2010

PART – I

(SOLVED MCQS)

Q. 1. Select the best option and fill in the appropriate Box on the answer sheet: (50 Marks)

1. Water is heated in a kettle. The inside water is heated by convection. A person sitting near the fire receives heat by:

(a) Conduction
(b) Convection
(c) Radiation
(d) Reflection
(e) None of these

2. A time can come when we will be able to design a machine which can go on working for ever without the expenditure of energy. Is it possible?

(a) No
(b) Yes
(c) In due course time
(d) Very soon
(e) None of these

3. The measurement of rainfall is made by an instrument known as:

(a) Hydrometer
(b) Barometer
(c) Hygrometer
(d) Pedometer
(e) None of these

4. Light year is a unit of:

(a) Distance
(b) Time Period
(c) Light intensity
(d) Time
(e) None of these

5. Three elements needed for the healthy growth of plants are:

(a) N,P,K
(b) N,C,P
(c) N,K,C
(d) N,S,P
(e) None of these

6. Copper can be converted into gold by:

(a) Heating
(b) Artificial Radioactivity
(c) Electroplating
(d) Chemical reaction
(e) None of these

7. In winter an iron pipe feel colder than a wooden window. This is because wood is:

(a) Conductor
(b) Non-Conductor
(c) Semi- Conductor
(d) Not a solid while iron is a solid
(e) None of these

8. The echo (reflected sound) will be distinctly heard only at ordinary temperatures if the distance of the reflecting surfaces from the source of sound is at least:

(a) 1120 ft
(b) 120 ft
(c) **56 fft**
(d) 100 ft
(e) None of these

9. **It is possible to recognize a person in the dark by simply hearing his unique voice. It is because of the:**
(a) **Pitch**
(b) Frequency
(c) Time period
(d) Quality
(e) None of these

10. **When a ray of sunlight enters a dark room, its straight path become visible because of dust particles hanging in the air. It is because light is:**
(a) **Visible**
(b) Transparent
(c) Invisible
(d) opaque
(e) None of these

11. **A six feet tall lady wants to see her full image in a plane mirror. The minimum length of the mirror will be:**
(a) 6 feet
(b) 12 feet
(c) 4 feet
(d) **3 feet**
(e) None of these

12. **The principle used in radar is the same as that of Sonar. In radar we use radio waves; whereas in sonar we use:**
(a) Red waves
(b) Infrared waves
(c) **Ultrasonic**
(d) Super sonic
(e) None of these

13. **In a fission nuclear reaction, a heavy nucleus breaks up into smaller nuclei whereas in another nuclear reaction two or more than two possibly nuclei are fused to form a heavy nucleus This nuclear reaction is called:**
(a) Chemical Reaction
(b) Nuclear reaction
(c) Fission nuclear reaction
(d) **Fusion nuclear reaction**
(e) None of these

14. **Parsec is a unit of:**
(a) Energy
(b) Time
(c) Power
(d) **Distance**
(e) None of these

15. **German Silver is an alloy of:**
(a) Zn + Ni
(b) Cu + Zn
(c) **Cu + Ni**
(d) Cu + Sn
(e) None of these

16. **The Continent Antarctica lies at the:**
(a) North pole
(b) **South pole**
(c) Middle of the Earth
(d) Equator
(e) None of these

17. **The temperature of the dead body is:**
(a) 0°C (b) 37°C
(c) Room temperature
(d) Temperature of the place where it is kept
(e) None of these

18. **Lactometer is a type of Hydrometer which is used to measure the specific gravity of:**
(a) Honey (b) Water
(c) Milk (d) Olive oil
(e) None of these

19. **Cusec is a unit of:**
(a) Area (b) Time
(c) Distance (d) Mass
(e) None of these

20. **The deepest place on Earth is:**
(a) Trench **(b) Mariana Trench**
(c) Mangrove (d) Groove
(e) None of these

21. **Twinkling of stars is caused by:**
(a) Reflection of light (b) Polarization of light
(c) Refraction of light (d) Interference of light
(e) None of these

22. **Magnifying power of a simple microscope can be increased by:**
(a) Increasing focal length of the lens
(b) Decreasing focal length of the lens
(c) Lens of large aperture
(d) Lens of short aperture (e) None of these

23. **Bronze medal is made up of metal:**
(a) Copper, Zinc (b) Copper, Nickle
(c) Copper, Tind (d) Sopper, Silver

24. **One of the countries through which equator passes is:**
(a) Kenya (b) Pakistan
(c) Malaysia (d) Malta
(e) None of these

25. **A very important practical application of properties of matter is hoeing or "godi" practiced by the farmers. This property of matter is called:**
(a) Elasticity (b) Stress
(c) Capillarity (d) Strain
(e) None of these

26. **It is observed that the total pressure exerted by air on the man of average size is around 14.7 lb wt. per square inch. But the man feels quite comfortable,. It is because of:**

(a) **An equal and opposite pressure acts from inside**
(b) Of the height of a man
(c) Of gravity
(d) Earth pulls the man upward
(e) None of these

27. **A nuclear reactor is a device used to carry out controlled nuclear reaction whereas GM counter is a device used to detect:**

(a) Current
(b) Voltage
(c) **Nuclear Radiation**
(d) Power
(e) None of these

28. **A body can escape the gravitational pull of the Earth if it is thrown up with a velocity of:**

(a) 25 miles per sec
(b) 60 miles per sec
(c) **7 miles per sec**
(d) 10 miles per sec
(e) None of these

29. **Night vision is possible with the help of:**

(a) Red light
(b) Violet light
(c) **Infrared Rays**
(d) Ultra violet Light
(e) None of these

30. **Myopia is a defect of human eye it can be corrected by using a lens called:**

(a) Convex lens
(b) **Concave lens**
(c) Cylindrical lens
(d) Plano convex lens
(e) None of these

31. **Walnuts can be broken in the hand by squeezing two together but not one. It is because of:**

(a) **Work done**
(b) Power
(c) Energy
(d) Volume
(e) None of these

32. **The instrument which is specially design for recording Earthquake wave is called seismograph which measure Earth quake waves on a:**

(a) Diatonic scale
(b) Fahrenheit Scale
(c) **Richter scale**
(d) Celsius Scale
(e) None of these

33. **The planet Mercury completes one rotation around the Sun is:**

(a) **88 days**
(b) 365 days
(c) 98 days
(d) 60 days
(e) None of these

34. **Fossils found in the lowest geological strata are generally most:**

(a) Advance
(b) Complex
(c) **Primitive**
(d) Specialized

(e) None of these

35. Evolution can be described as:

(a) A continuing process
(b) A catastrophic event in the past
(c) Static
(d) The attaining of an ideal type
(e) None of these

36. What is the only source of new alleles?

(a) Crossing over
(b) Independent assortment
(c) Mutation
(d) Fertilization
(e) None of these

37. Polygenic characteristic are controlled by:

(a) Dominant genes
(b) Recessive genes
(c) Multiple genes
(d) Mutated genes
(e) None of these

38. Which of the following, lists the four stages of food processing in order?

(a) Ingestion, digestion, absorption, elimination
(b) Digestion, ingestion, absorption, elimination
(c) Ingestion, absorption, elimination, digestion
(d) Absorption, digestion, ingestion, elimination
(e) None of these

39. In humans, most nutrient molecules are absorbed by the:

(a) Small intestine
(b) Stomach
(c) Liver
(d) Large intestine
(e) None of these

40. The energy needed to fuel essential body processes is called:

(a) Essential nutrient level
(b) Basal metabolism
(c) None of these
(d) Recommended daily allowance
(e) Optimum energy intake

41. Which of the following is an organic molecule needed by the body in small amounts?

(a) Protein
(b) Vitamin C
(c) Zinc
(d) Monosaccharide
(e) None of these

42. Inhaled air passes through which of the following in the last?

(a) Bronchiole
(b) Larynx
(c) Pharynx
(d) Trachea
(e) None of these

43. Which of the following is a form of sexual reproduction?

(a) Hermaphroditism
(b) Fission
(c) Fragmentation
(d) Budding
(e) None of these

44. Cobalt is a material which is:

(a) Strongly attracted by a magnet

(b) Not attracted by a magnet (c) Not a magnet

(d) Weakly attracted by a magnet (e) None of these

45. Laughing gas has chemical composition of the following two elements which are:

(a) Nitrogen + Hydrogen (b) Nitrogen + Carbon

(c) Nitrogen + oxygen (d) Oxygen + Carbon

(e) None of these

46. Hepatitis A is transmitted to different individuals by:

(a) Water (b) Sneezing

(c) Spit (d) Feces

(e) None of these

47. The unit that coordinates different devices of the computer system is:

(a) ALU (b) Register

(c) Control unit (d) Logical instruction

(e) None of these

48. The most abundant element present is in the human body is:

(a) Nitrogen (b) Oxygen

(c) Carbon **(d) Hydrogen**

(e) None of these

49. Cancer can be treated by:

(a) Antibiotics and vaccines

(b) Radiotherapy and antibodies

(c) Chemotherapy and radiotherapy

(d) Antibodies and chemotherapy

(e) None of these

50. Animals obtain carbon dioxide mainly from:

(a) Starch (b) Sucrose

(c) Glucose (d) Glycogen

(e) None of these

PART – II

Attempt only five questions. All questions carry equal marks. (50 Marks)

Q. 2. Write shot note on the following by giving their exact life span and contributions to the field of science. (10)

(a) Al- Beruni (b) Ibn- al – Haitham

Ans. (See Ch. 1)

Q. 3: What do you know about hereditary disease? Comment how they are transferred from parents to offsprings? (10)

Ans. (See Ch. 2, portion of Genetic Diseases)

Q. 4: **Write briefly any five of the following: (Answer in three or four sentences)** (10)

(a) **Plaster of Paris:**

Ans. It is a compound of Calcium. When hydrated, the form is rigid. It is a blessing for broken bones. It is also used for architecture designing (Model designing, Sculptures and for filling purposes in different areas.

(b) **Reflex Action:**

Ans. A reflex action, also known as a reflex, is an involuntary and nearly instantaneous movement in response to a stimulus. In most contexts, in particular those involving humans, reflex actions are mediated via the reflex arc; this is not always true in other animals, nor does it apply to casual uses of the term 'reflex'.

(c) **Pace Maker:**

Ans. A pacemaker or artificial pacemaker, is a medical device which uses electrical impulses, delivered by electrodes contacting the heart muscles, to regulate the beating of the heart. The primary purpose of a pacemaker is to maintain an adequate heart rate, either because the heart's native pacemaker is not fast enough, or there is a block in the heart's electrical conduction system.

(d) **Swine flue:**

Ans. (See Ch. 2)

(e) **Microwave oven:**

Ans. (See solved paper 2003)

(f) **Internet:**

Ans. The Internet is a global system of interconnected computer networks that use the standard Internet Protocol Suite (TCP/IP) to serve billions of users worldwide. It is a network of networks that consists of millions of private, public, academic, business, and government networks of local to global scope that are linked by a broad array of electronic and optical networking technologies. The Internet carries a vast array of information resources and services, most notably the inter-linked hypertext documents of the World Wide Web (WWW) and the infrastructure to support electronic mail.

(g) **Voltage Stabilizer:**

Ans. A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. It may use an electromechanical mechanism, or passive or active electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.

Q. 5: (A) **What is global warming? Is there any a sunny side to global warming? If yes, explain.** (5)

Ans. (See Ch. 1, Global Warming and solved past paper)

(B) **What makes the seasons happen?** (5)

Ans. (See Ch. 1, Day Night and Seasons)

Q. 6: In which region of the world, the following animals are found? Give two main characteristics of each) (10)

Blind dolphin:

Ans. **Region:** Indus River, Sukkur, Pakistan.

The Indus River Dolphin has a long beak and a stocky body. It has a low triangular hump on its back in place of a 'true' dorsal fin. It is gray-brown in color, sometimes with a pinkish belly.

(b) **Kangaroo:**

Ans. **Region:** Australia

They are large marsupials. A kangaroo has a strong back bone and four legs. The back two are stronger then the front two. It gives birth to undeveloped young which crawl up to the pouch to continue maturing.

(c) **Panda:**

Ans. **Region:** China

The Giant Panda is a bear native to central-western and south western China. It is easily recognized by its large, distinctive black patches around the eyes, over the ears, and across its round body.

(d) **Kiwi:**

Ans. **Region:** New Zealand

Kiwis – flightless birds, grow to about the size of a chicken and weigh between three and nine pounds. They have no tail and tiny two inch wings which for all practical purposes, are useless.

(e) **Penguin**

Ans. **Region:** Antarctica

Penguins are a group of aquatic, flightless birds living almost exclusively in the southern hemisphere, especially in Antarctica.

Q. 7: (A) In which organ these parts are present in animals or human body? (5)

(B) Describe the function of each briefly: (5)

Ans.

1. **Coronary artery:** Present in heart muscles. Provides oxygenated blood and nutrients to heart muscles.

2. **Sino- Auricular Node:** The sinoatrial node or sinoauricular node is the impulse-generating (pacemaker) tissue located in the right atrium of the heart, and thus the generator of normal sinus rhythm.

2. **Aortic valve:** Present in aorta, the largest artery. It prevents the backflow of blood to the heart chambers.

3. **Auricle:** Present in heart. There are two auricles in the heart, right and left. Right auricle collects deoxygenated blood and pumps it into right ventricle. Left auricle receives oxygenated blood from pulmonary vein and pumps it into left ventricle to distribute into the body.

Q. 8: Differentiate between the following pairs:

(a) **Hydrometer and Hygrometer:**

Ans. A **hydrometer** is an instrument used to measure the specific gravity (or relative density) of liquids; that is, the ratio of the density of the liquid to the density of water.

Hygrometer is instrument used for measuring relative humidity.

(b) Perimeter and Telemeter:

Ans. A **perimeter** is used to determine the area outline of a shape. The perimeter of a circular area is called circumference.

A **telemeter** is a device used to transmit measurements of a quantity to a remote location. Telemeters are generally the physical devices used in telemetry and consist either of analog or digital transmitters.

(c) Isotopes and Isomers:

Ans. **Isotopes** are different types of atoms (nuclides) of the same chemical element, each having a different number of neutrons.

In chemistry, **isomers** are compounds with the same molecular formula but different structural formulas.

(d) Flying mammal and Bird:

Ans. **Flying Mammals** are said to fly, such as flying squirrels, gliding possums and colugos, glide rather than fly, and only for short distances. Bats are considered as only flying mammals. The **Birds** (class Aves) are winged, bipedal, endothermic (warm-blooded, egg-laying, vertebrate animals.

(e) Vertebrates and Invertebrates:

Ans. **Vertebrates** are members of the subphylum Vertebrata, chordates with backbones or spinal columns.

An **invertebrate** is an animal without a backbone. The group includes 95% of all animal species.

Q. 9: (A) what are pesticides? Explain how these are dangerous to human beings?

Ans. (See Ch. 1, Pesticides)

(B) What do the following scientific abbreviations stand for?

(1) **STP**: Standard Temperature and Pressure

(2) **LORAN**: Long Range Navigation

(3) **SONAR**: Sound Navigation and Ranging

(4) **MAF**: Million Acre Feet

(5) **MeV**: Million Electron Volt, Mega electron Volt

(6) **MASER**: Microwave Amplification By Stimulated Emission of Radiation

(7) **AWACS**: Airborne Warning and Controlling System

(8) **CCTV**: Closed Circuit Tele Vision

EVERYDAY SCIENCE 2011

PART – I

(SOLVED MCQS)

1. The planet of the solar system which has maximum numbers of Moon is:

(a) Jupiter (b) Venus
(c) Saturn (d) Uranus
(e) None of these

2. Sun is a:

(a) Planet (b) Comet
(c) Satellite (d) Aurora
(e) None of these (star)

3. The age of the solar system is

(a) 4.5 billion years
(b) 5.5 billion years (c) 6.5 billion years
(d) 7.5 billion years (e) None of these

4. A unit of length equal to the average distance between the earth and sun is called

(a) Light year **(b) Astronomical unit**
(c) Parsec (d) Parallax
(e) None of these

5. An eclipse of the sun occurs when

(a) The moon is between the sun and the earth
(b) The sun is between the earth and the moon
(c) The earth is between the sun and the moon
(d) The earth casts its shadow on the moon
(e) None of these

6. The ozone layer protects the earth from rays sent by the sun:

(a) Ultraviolet rays
(b) Infrared rays (c) Gamma rays
(d) Radioactive rays (e) None of these

7. The ozone layer is present about 30miles (50km) in atmosphere above earth. The stratum (layer) of atmosphere in which ozone layer lies is called as:

(a) Exosphere (b) Mesosphere
(c) Stratosphere (d) Ionosphere
(e) Troposphere

8. Which rocks are formed by the alteration of pre-existing rocks by great heat or pressure?

(a) Igneous rocks (b) Sedimentary rocks
(c) Metamorphic rocks (d) Acid rocks

(e) Basic rocks

9. The most abundant natural Iron oxides are

(a) Magnetite and Pyrite
(b) Magnetite and Bauxite
(c) Hematite and Pyrite
(d) Hematite and Magnetite
(e) Hematite and Bauxite

10. The most abundant elements in sea water are

(a) Sodium and Potassium
(b) Sodium and Calcium
(c) Sodium and Chlorine
(d) Chlorine and Iodine
(e) Magnesium and Sulphur

11. An electric current can produce

(a) Chemical effect
(b) Magnetic effect
(c) Heating effect
(d) All of these three
(e) None of these

12. The unit of home electricity energy consumption is:

(a) Watt hour
(b) Kilowatt hour
(c) Joule hour
(d) Kilojoule hour
(e) None of these

13. The magnet always points in the same direction, if move freely i.e. toward north and south poles, because of:

(a) Gravitational field
(b) A lot of metals deposits on north and south poles
(c) Due to attraction of north pole and repulsion of Western pole
(d) Earth is a huge magnet
(e) None of these

14. When sound is reflected from floor, ceiling or a wall, it mixes with the origina sound and change its complexion, it is called as

(a) Sound
(b) Echo
(c) Reverberation
(d) Noise
(e) None of these

15. The speed of sound in dry air at 20 C is about

(a) 130 meters per second
(b) 230 meters per second
(c) 330 meters per second
(d) 430 meters per second
(e) None of these

16. The speed of light in vacuum is about

(a) 300 Million meters per second
(b) 300 Million meters per hour
(c) 300 Million kilometers per second
(d) 300 Million kilometers per hour
(e) None of these

17. The time light takes from Sun to reach Earth is:

(a) 8 minutes
(b) 25 minutes

(c) 45 minutes (d) 60 minutes
(e) None of these

18. Light from Sun travels a distance before it reaches Earth:
(a) 50 Million Km (b) 100 Million Km
(c) **150 Million Km** (d) 200 Million Km
(e) None of these

19. The most suitable thermometer for measuring the boiling point of water is:
(a) **Mercury thermometer** (b) Alcohol thermometer
(c) Bimetallic thermometer (d) Liquid crystal thermometer
(e) None of these

20. The density of water is greatest at:
(a) 32°C (b) 0°C
(c) 4°C (d) 100°C
(e) None of these

21. Which one of the following statements is true:
(a) Gases do not conduct heat
(b) The best conductors are non-metals
(c) Conduction currents occur only in liquids
(d) A vacuum cannot conduct heat
(e) None of the statements is true.

22. Ice can be changed to water by:
(a) Adding more water molecules
(b) Changing the motion of the water molecules
(c) Rearranging the atoms in water molecules
(d) Destroying the atoms in water molecules
(e) None of these

23. The building blocks of elements are called:
(a) Atoms (b) Molecules
(c) Compounds (d) Isotopes
(e) None of these

24. Boiling of an egg is a change which is:
(a) Physical **(b) Chemical**
(c) Physiological (d) Morphological
(e) None of these

25. The temperature of liquid nitrogen is:
(a) −32°C (b) −80°C
(c) −100°C **(d) −196°C**
(e) None of these

26. Which one of the following is an alkali?
(a) Water (b) Vinegar

(c) Lemon juice (d) Slaked lime
(e) None of these

27. If an alkali is slowly added to an acidic solution, the pH of the acidic solution will:

(a) Increase (b) Decrease
(c) Increase to 7 and then decrease
(d) Decrease to 7 and then increase
(e) Will remain same

28. The usual raw material for ceramics, generally found beneath the top soil is?

(a) Sand (b) Slit
(c) Clay (d) Plaster of Paris
(e) Melamine

29. Polyamides are synthetic polymers commonly known as:

(a) Synthetic rubber **(b) Nylon**
(c) Cellulose (d) Protein
(e) None of these.

30. Telephone was invented in 1876 in America by:

(a) Marconi (b) Galileo
(c) John Beard (d) Edison
(e) Graham Bell.

31. Information can be sent over long distances in the form of:

(a) Electrical signals through wires
(b) Light signals through optical fibres
(c) Radio waves through air
(d) Any combination of these three.
(e) None of these

32. Information can be stored in:

(a) Audio and video cassettes (b) Floppy and compact discs
(c) Hard disks (d) Laser and optical disks
(e) All of these four

33. Computers can:

(a) Add and subtract information only.
(b) Add subtract and sort information only.
(c) Add subtract sort and classify information.
(d) Add and subtract but cannot sort information.
(e) Add subtract and sort but cannot classify information.

34. IBM stands for:

(a) International Business Machines
(b) International Big Machines
(c) Interrelated Business Machines

[redacted]

(d) Interrelated Big Machines
(e) None of these.

35. Chemicals used to kill weeds are called as:
(a) Insecticides
(b) Fungicides
(c) Herbicides
(d) Fumigants
(e) None of these.

36. The cytoplasm consists of several types of structures, which are called:
(a) Protoplasm
(b) Nucleus
(c) Cytochromes
(d) Organelles
(e) None of these.

37. The structure of DNA was elaborated by Watson and Crick in:
(a) 1909
(b) 1923
(c) 1945
(d) 1953
(e) None of these.

38. In a DNA molecules, the rule for base pairing is:
(a) Adenine always bound with thymine and cytosine with guanine
(b) Adenine always bound with cytosine and thymine with guanine
(c) Adenine always bound with guanine and cytosine with thymine
(d) Adenine always bound with uracil and cytosine with guanine
(e) None of these.

39. Man belongs to the family:
(a) Felidae
(b) Hominidae
(c) Mammalia
(d) Primataceae
(e) None of these.

40. Deficiency of vitamin C in human body causes a deficiency disease called:
(a) Beriberi
(b) Night blindness
(c) Rickets
(d) Scurvy
(e) None of these.

41. To measure the specific gravity of milk, the instrument used is:
(a) Hygrometer
(b) Barometer
(c) Lactometer
(d) Hydrometer
(e) None of these.

42. One of the fundamental characteristics of living organisms is:
(a) Photosynthesis
(b) Digestion
(c) Excretion
(d) Metabolism
(e) None of these.

43. Plants growing on other plants are called as:
(a) Saprophytes
(b) Parasites
(c) Epiphytes
(d) Pathogens
(e) None of these.

44. **As per eating habit, squirrels are:**

(a) Frugivorous
(b) Herbivorous
(c) Carnivorous
(d) Omnivorous
(e) Insectivorous.

45. **Water loss from leaves through stomata is called as:**

(a) Evaporation
(b) Transpiration
(c) Evapo-Transpiration
(d) Respiration
(e) None of these.

46. **The study of how plants and animals interact with one another and with the non-living environment is called as:**

(a) Ecosystem
(b) Sociology
(c) Ecology
(d) Habitat
(e) None of these.

47. **The number of bones in human body is:**

(a) 200
(b) 202
(c) 204
(d) 206
(e) None of these.

48. **Nervous system in human consists of:**

(a) Brain and spinal cord.
(b) Brain and nerves.
(c) Spinal cord and nerves.
(d) Brain, spinal cord and nerves.
(e) None of these.

49. **In human eye, the light sensitive layer made of specializes nerve cells, rods and cones is called as:**

(a) The pupil
(b) The cornea
(c) The sclera
(d) The iris
(e) The retina.

50. **Erythrocytes are also called as:**

(a) Red blood cells
(b) White blood cells
(c) Platelets
(d) Plasma
(e) None of these

Q2. Write a short note on the following Muslim scientists by giving their exact life span and contribution to the field of science:

(a) Jabar-bin-Hayan
(b) Bu Ali Sina

Ans. See Appendices.

Q3. Differentiate between any Five of the following pairs:

(a) Typhoons and Tornadoes:

Typhoon: They produce torrential rains, winds from 74 to up to 160 mph. Heavy flooding is often associated, Large scale storm systems that may range in diameter from 100-1000 miles, they occur in the western Pacific Ocean and tend to be more intense than hurricanes because typhoons have more open water to cover

Tornadoes: A far more localized storm whose diameter ranges from 50 meters to up to 1.5 miles. Often occur in the central United States where cold air from Canada, warm moist air from the Gulf of Mexico, a boundary between dry and moist air, a pocket of moisture in the atmosphere and varying wind speeds and directions in the atmosphere must be present to form tornadoes. Winds can range from 60 to up to 320 mph.

(b) Microscope and Telescope:

Ans. Solved paper 2008, also see Telescope in Ch. 1, Microscope in Ch. 2.

(c) Ultrasonics and Infrasonics:

Ultrasonic: above the audible frequency which is 20000 Hz, bat can hear up to 120,000 Hz.

Infrasonic: below 20000 Hz are called Infrasonic which is audible to Human ear.

(d) Hard water and Heavy water:

Ans. Solved paper 2009

(e) Isotopes and Isomers:

Ans. Solved paper 2010

(f) Antibodies and Antibiotic:

Ans. Antibiotic: See Chapter 2.

Antibodies: Antibodies are what your body produces in response to the presence of antigens (bacterial or viral surface structures). They merely assist your white blood cells in identifying and destroying invading microorganisms.

(g) Antigens and Vaccine:

Antigens: term came from antibody generator, substance when introduced in body triggers the production of antibodies by the immune system.

(h) ***Vaccine:***

Ans. See Chapter 2.

Q4(a) What is galaxy? The Earth belongs to which galaxy?

Ans. See Chapter 1.

(b) Briefly describe what is big bang theory.

Ans. See Chapter 1.

(c) Do you think that Pluto is still ninth planet of our solar system? If yes, how and if not why?

Ans. Pluto is not any more the ninth planet in 2006 it has been declared by many astronomers that due to some reasons Pluto should not be included in solar system.

1. It is too small to call a planet, it belongs to dwarf planets.
2. Its orbit around sun is not in same way as the other planets revolve around sun.

Q5(a) Basically how many forms of energy are there? Also name these.

Ans. See Chapter 3.

(b) Enlist different types of energy.

Ans. See Chapter 1.

(c) What is renewable energy source? Quote three examples of renewable energy sources.

Ans. See Chapter 1.

Q6: **Is plastic a natural or an artificial polymer? Describe various types of plastics and their uses.**

Ans. See Chapter 1.

Q7(a) **What do the following abbreviations stand for?**

(i) LAN (land area network)
(ii) HTTP (Hyper Text transfer protocol)
(iii) HTML (hypertext markup language)
(iv) PDF (portable document format)
(v) URL (uniform resource locator)

(b) **Differentiate between natural and artificial Satellite. For what purpose artificial satellites are used?**

Ans. Satellites are the objects which revolve around the planet. Moon is a natural satellite of earth, mars have two natural satellites, where as artificial satellites also revolve around the planet but they are manmade (See Ch. 4, the communication system).

Q8(a) **What is the main function of:**

(i) Ribosome
(ii) Mitochondria
(iii) Lysosomes
(iv) Chloroplasts
(v) Golgi apparatus

Ans. See Chapter 5, portion of cell.

(b) **Give habitats of following animals:**

(i) Rattle Snake (America, Canada, Argentina)
(ii) Ostrich (Arab, Africa)
(iii) Platypus (Australia)
(iv) Rhinoceros (Africa, southern Asia)
(v) Chimpanzee. (Africa

Q9. **Write note on the following:**

(a) **Nucleic acids**

Ans. Please see solved paper 2001, DNA and RNA).

(b) **Fertilizers**

Ans. (See Ch. 1).

(c) **Semiconductors**

Ans. (See Ch. 1)

(d) **Microwave oven**

Ans. (Solved paper 2001).

(e) **Internet:** It is a global system of inter connected computer networks which use standard internet protocols IP to serve billions of users.

EVERYDAY SCIENCE 2012

PART – I (SOLVED MCQS)

(1) **A scientific method will seek to explain natural events and make useful prediction in**
(a) A haphazard manner
(b) A manner design to fit the theorist's or experimenter's bias
(c) A consistently reproducible manner (d) None of these

(2) **"Truth is the sought for its own sake and those who are engaged upon the quest for anything for its own sake are not-interested in other things. Finding the truth is difficult and the road to it is rough." This was stated by which key figure in the development of scientific method in the 11th century?**
(a) Aristotle **(b) Ibn al Haytham**
(c) Plato (d) None of these

(3) **Abu Abdullah Muhammad bin Musa al-Khwarizmi is famous for writing the "Kitab al Jaber Wal Muqabla" in which he**
(a) Presented the first systematic solution of linear and quadratic equations
(b) Delineated methods of oppression & competition
(c) Wrote the laws of optics (d) None of these

(4) **Gallieo gallies was perescuted by the Catholic Church for suspicion of holding the view that:**
(a) Objects of different masses fell at the ame velocity
(b) The sun revolves arounds the moon
(c) The earth was probably not the centre of the universe
(d) None of these

(5) **The proliferation of education and dissemination of knowledge in the last two centuries has led to a faith in science that:**
(a) Causes human beings to turn on other human beings
(b) Is the main cause of poverty and war
(c) Leads to oppression of education **(d) None of these**

(6) **science attempts to:**
(a) Explains how the universe works by discovering the laws regulating every-thing around us
(b) Use discovered laws to engineer new devices
(c) Both a & b (d) None of these

(7) **Ibn Zuhr, the author of al Taysir, is known as:**
(a) The father of experimental surgery
(b) The founder of calculus
(c) A biographer of provincial governors (d) None of these

(8) **Ibn Khaldun's Muqqadimah is regarded by many as:**
(a) The first work dealing with a philosophy of history
(b) A minor footnote in his writings
(c) A well documented tale of his trial (d) None of these

(9) **A physical, mathematical or logical representation of a natural phenomenon is called**

(a) Phenomenal (b) **A scientific model**
(c) A theoretical postulate (d) None of these

(10) Issac Newton and Gottfried Leibniz working independently in the 17th century laid the foundation of classical physics and are known as fathers of

(a) Astrology (b) Relativistic theory
(c) Integral & differential calculus (d) None of these

(11) A light year is

(a) A year devoid of heavy rainfall
(b) The time taken by light to be generated & propagated from the centre of the sun to our earth
(c) The distance covered by light in one of our solar years (d) None of these

(12) Our sun is classified as

(a) A blue giant **(b) A yellow dwarf**
(c) Supernova (d) None of these

(13) The sun produces most of its energy by:

(a) Nuclear fusion which involves converting "h" to "he"
(b) Nuclear fission involving the burning of uranium & plutonium
(c) Nuclear fission involving the combining of uranium and palladium
(d) None of these

(14) Which of the following is the correct ordering of the inner planets according to their proximity to the sun

(a) Jupiter, Saturn, Uranus, Neptune (b) Phobos, Deimes, Europe, Tias
(c) Mercury, Venus, Earth, Mars (d) None of these

(15) How long does our earth takes to turn about its axis?

(a) One hour (b) 23 hours **(c) 24 hours** (d) None of these

(16) Tides are generated by

(a) The movements of ships in the oceans
(b) The gravitational effect of moon and sun on our earth
(c) The movements of the earth around the sun (d) None of these

(17) Seasons are generated by

(a) The movement of sun around coabes of the milky way
(b) The movement of the earth around the sun
(c) Relativistic quantium ------------------------ (d) None of these

(18) Although the mass of a man on moon remains same as on the earth, he will

(a) Be much happier there **(b) Weigh one sixth as much**
(c) Weigh twice as much (d) None of these

(19) If we are at see level our atmosphere presses down on us with a pressure of:

(a) 1 fps **(b) 14.3 fps** (c) 35.8 fps (d) None of these

(20) The efficiency of a machine is

(a) Always greater than 100% **(b) Always less than 100%**
(c) Always 100% (d) None of these

(21) A material with high elasticity

(a) Does not returns to its original shape upon being stretched and then released
(b) Returns as close as possible to its original shape upon being stretched and then released
(c) Can be stretched to infinite distances (d) None of these

(22) Matter and energy

(a) **Can be converted from one to the other**
(b) When taken together, converted in all processes in a closed system
(c) Both a & b (d) None of these

(23) **Electric current**
(a) Flows from a higher potential to lower potential
(b) **Is caused by flow of electrons**
(c) Both a & b (d) None of these

(24) **Electricity and magnetism are**
(a) **Two facets of same force** (b) Always opposed to each other
(c) Both a & b (d) None of these

(25) **Ball bearing help wheels and other rotating objects**
(a) Move without consuming any energy
(b) **Rotate more easily and with less friction**
(c) Both a & b (d) None of these

(26) **Photography works by**
(a) Capturing the souls of the objects being photographed
(b) **Capturing light reflected from the object being photographed**
(c) Both a & b (d) None of these

(27) **Arthur C. Clarke, the famous science fiction author, while working as a radio operator in the British Army in World War-II**
(a) Proposed building a space elevator from carbon mono-filaments
(b) Postulated the existence of extra-terrestrial artifacts on the moon
(c) **Proposed that a network of satellites in stationary orbit at very high altitudes around the earth be used to bounce communication signals all over the world** (d) None of these

(28) **The Sino-Pakistani JF-17 thunder aircraft:**
(a) Is a commercial transport aircraft
(b) Is neither built nor assembled in Pakistan
(c) Has no steath features in its engine inlets or elsewhere **(d) None of these**

(29) **Communication satellites are in**
(a) **Geostationary orbit** (b) Geosynchronous orbit
(c) Semi-synchronous orbit (d) None of these

(30) **Ram of a computer is refers to:**
(a) Read access memory (b) Right access memory
(c) **Random access memory** (d) None of these

(31) **Which of the following is responsible for transporting oxygen in the blood**
(a) White blood cells-------WBC (b) Neutrophills
(c) **Red blood cells---------RBC** (d) None of these

(32) **Which of the following is true for hormones?**
(a) All proteins are hormones (b) All hormones are proteins
(c) All hormones are amino acids **(d) None of these**

(33) **Prokaryotes have which of the following structures?**
(a) Nucleus (b) Mitochundria
(c) Chloroplast **(d) None of these**

(34) **Diversity in which of the following groups is not due to artificial selection?**
(a) Wheat (b) Dogs

(c) ------------------------ (d) None of these

(35) **Arachnophobia is refer to a fear of**
(a) **Spiders** (b) Snakes (c) Bats (d) None of these

(36) **Which of the following is a part of DNA?**
(a) **DGTP** (b) DADP (c) DTMP (d) None of these

(37) **In humans the "y" chromosome is passed to the next generation from**
(a) Father to son (b) Mother to son (c) Father to daughter (d) None of these

(38) **Which of the following is a mammal?**
(a) Blue tuna (b) Sword fish **(c) Whale** (d) None of these

(39) **Female ova are:**
(a) **haploid** (b) Diploid (c) Triploid (d) None of these

(40) **Which of the following is not a part of DNA?**
(a) Thymine (b) Adenine (c) Ribose **(d) None of these**

(41) **Which of the following is a labeled as "good cholesterol" for humans?**
(a) High-density lipoprotein--------------HDL
(b) Low density lipoprotein--------------- LDL
(c) Very low density lipoprotein ------VLDL (d) None of these

(42) **Which of the following is a infectious disease**
(a) Deafness (b) Blindness
(c) Baldness **(d) None of these**

(43) **Which of the following is a non essential amino acid?**
(a) Alanine (b) Methionine
(c) Tyrosine (d) None of these

(44) **Starting from higher choose the correct sequence of molecules in order of energy yielding**
(a) Sugar, fats, protein (b) Protein, sugar, fats
(c) Fats, sugar, protein **(d) None of these**

(45) **Which of the following is not a part of protein?**
(a) Glutamic acid **(b) Sulphuric acid**
(c) Aspartic acid (d) None of these

(46) **The highest source of omega-3 fatty acid is**
(a) Fish oil (b) Corn oil (c) Sunflower oil (d) None of these

(47) **Which of the following gas is essential for human**
(a) Carbon dioxide (b) Nitrogen **(c) Oxygen** (d) None of these

(48) **Proteins are made up of**
(a) polynucleotide **(b) polypeptide** (c) polyacetylene (d) none of these

(49) **Schezophrenia is a Mental desease**

(50) **Which of the following are founded in the nucleus?**
(a) Lysosomes **(b) Chromosomes** (c) Ribosomes (d) None of these

PART II

Q2: Write briefly about two or more major achievements of each of the following two famous Muslim scientists:
(a) Abu Abdullah Mohammad Bin Musa Al Khwarizmi
(b) Abu Ali Al Hassan Ibn Al Hassan Al Haytham (5, 5)

Ans. See Appendices.

Q3(a) List four or more physical characteristics of the Earth. (5)

Ans. See Chapter 1.

(b) Briefly explain how seasons and ocean tides are produced on the Earth?

Ans. See Chapter 2 (Day, Night and Seasons).

Q4(a) Very briefly explain the difference between Earthquakes, volcanic eruptions, floods and tsunamis. **(5)**

Ans. Earthquakes (See Ch. 1), Volcanic eruptions (See Ch. 1).

Floods: A flood is an overflow of water that submerges land. Floods can also occur in rivers, when flow exceeds the capacity of the river channel, particularly at bends or meanders. Floods often cause damage to homes and businesses if they are placed in natural flood plains of rivers.

Tsunami: A tsunami is a series of water waves caused by the displacement of a large volume of a body of water, typically an ocean or a *large lake. Earthquakes, volcanic eruptions* and other *underwater explosions* (including detonations of underwater *nuclear devices*), landslides, *glacier calvings, meteorite impacts* and other disturbances above or below water all have the potential to generate a tsunami.

(b) Briefly explain the difference between Sedimentary and Metamorphic rocks.

Ans. Sedimentary rock (see solved paper 2007). **(5)**

Metamorphic rocks: The metamorphic rocks are formed by the alteration of pre-existing rocks by great heat or pressure

Q5(a) Very briefly explain the difference between an Insulator, a Conductor, a Semiconductor and a Superconductor. **(5)**

Ans. See Chapter 1 (Semi Conductors).

(b) Briefly explain the difference between a LASER and a Photovoltaic Cell.

Ans. LASER (See Ch. 1). **(5)**

Photovoltaic cell: A solar cell (also called a photovoltaic cell) is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect. It is a form of photoelectric cell (in that its electrical characteristics-- e.g. current, voltage, or resistance-- vary when light is incident upon it) which, when exposed to light, can generate and support an electric current without being attached to any external voltage source. Materials presently used for photovoltaic solar cells include monocrystalline silicon, polycrystalline silicon, amorphous silicon, cadmium telluride, and copper indium selenide/sulfide.

Q6(a) Briefly explain the difference between an Antibiotic, an Antiviral Drug, a Pesticide and a Vaccine.

Ans. Antibiotic (See Ch. 1), Pesticide (See Ch . 1), Vaccine (See Ch. 2).

(b) List any two of the three things that the MMR vaccine protects against. List any two other vaccines given to children. **(05)**

Ans. Polio Vaccine, Hepatitis Vaccine

Q7(a) Briefly explain how Photosynthesis works? **(05)**

Ans. Photosynthesis is the synthesis of Glucose. Scientifically, it can be defined as "A biochemical process in which green plants in the presence of chlorophyll form glucose by the combination of carbon dioxide and water". The process takes place in the presence of light.

This process also takes place in some green algae and some bacteria (photosynthetic bacteria). During day time, carbon dioxide enters the plant cells through stomata and water comes from ground to the cells by xylem vessels. During light reaction (a phase of photosynthesis that takes place in the presence of light), high energy molecules (ATP, NADPH) are formed, while during dark reaction (a phase of photosynthesis that takes place in the absence of light), carbon dioxide is reduced to form glucose by the utilization of ATP and NADPH which were formed during light reaction. Oxygen is released as a byproduct of photosynthesis.

The summary of the photosynthesis can be described in the form of a chemical reaction, that is:

$$6CO_2 + 6H_2O \longrightarrow \text{sunlight} \quad C_6H_{12}O_6 + 6O_2$$

(b) Briefly explain the Nitrogen Cycle in nature. (05)

Ans. Nitrogen is an important component of many bio-molecules, like proteins and nucleic acids. Our atmosphere contains about 78% nitrogen but living organisms except some bacteria can not utilize gaseous nitrogen directly from the atmosphere, so it has to be converted into the nitrates to be utilized by the plants. The nitrogen cycle comprises following steps:

- **Nitrogen Fixation:** the conversion of nitrogen gas into nitrates is called nitrogen fixation.
- **Ammonification:** in this step, the breakdown of proteins of dead organisms takes place. The process is done by ammonifying bacteria in the soil, and the proteins and other nitrogen containing compounds are converted into the ammonia.
- **Nitrification:** Ammonia is converted into the nitrates and nitrites by nitrifying bacteria.
- **Assimilation:** The nitrates are then absorbed by the plants, where they are utilized to make proteins. The utilization of nitrates is called assimilation.
- **Denitrification:** this process is done by denitrifying bacteria in which nitrates and nitrites are reduced to form nitrogen gas which is returned into the atmosphere.

Q8(a) Differentiate between the following: (05)

- **DNA**: It is the genetic material which is transferred from parents to offspring. Chemically it is composed of deoxyribose sugar, nucleotides and phosphate.
- **mRNA (Messenger RNA):** It is formed from DNA•by the process of transcription. mRNA is not a genetic material. Chemically it is formed of ribose sugar, nucleotides and phosphate.
- **Proteins:** Proteins are formed from mRNA by the process of translation. Chemically they are formed of amino acids. There are 20 different kinds of amino acids which form thousands of different types of proteins.

(b) Explain how DNA, m RNA and Proteins are interrelated to each other? (05)

Ans. DNA is the genetic material, it contains information in the form of genes. The genes are specific segments of DNA which contain specific information (protein synthesis) in the form of nucleotide sequences.

mRNA is formed from DNA by a process called transcription. In this process, the information for the synthesis of a specific type of protein is transferred to mRNA from DNA. The mRNA with the help on rRNA and tRNA and ribosomes translates the information present in it to form a specific type of protein.

Q9(a) Explain what is mean by a Balanced Diet? (05)

Ans. See Ch. 4.

(b) Give the major function of the following micronutrients:
Vitamin A, Vitamin C, Iron, Calcium and Iodine. (05)

Ans. See Ch 4.

EVERYDAY SCIENCE 2013

PART – I

(SOLVED MCQS)

Q. 1. Select the best option and fill in the appropriate circle:

1. Who proposed the concept "All motion is relative"?
   (a) Albert Einstein (b) John Kepler
   (c) Galileo Galilie (d) None of these
2. The field of specialization of famous Muslim scientist Abu Usman Aljahiz was:
   (a) Botany (b) Zoology
   (c) Astronomy (d) None
3. Albatros is:
   (a) A sea bird (b) A beetle
   (c) A fruit (d) None
4. The sunlight can reach a depth of .... meters in the ocean:
   (a) 100 (b) 80
   (c) i20 (d) None
5. The biggest planet in our solar system is:
   (a) Venus (b) Pluto
   (c) Jupiter (d) None
6. The biggest species of the cat family is:
   (a) Tiger (b) Lion
   (c) Leopard (d) None
7. Which group of animals has heterogametic females?
   (a) Domestic fowl (b) Earthworm
   (c) Rabbit (d) None
8. The dominant phase of life cycle in these organism is haploid:
   (a) Mosses (b) Bacteria
   (c) Protoza (d) None
9. The atmosphere of moon consists of:
   (a) 90% Hydrogen, 10% Nitrogen (b) 80%Nitrogen, 20% Hydrogen
   (c) 60% Nitrogen, 40%inert gases (d) None
10. The chemical name of quartz is:
    (a) Silicon Dioxide (b) Stannous Oxide
    (d) None
11. Which month of calendar year can lack a new moon?
    (a) December (b) February
    (c) May (d) None
12. Deuterium differs from Hydrogen in having:
    (a) Different atomic number but same atomic weight

(b) Different atomic number and different atomic weight
(c) Same atomic number and different atomic weight
(d) None

13. One of the following is a water soluble vitamin:
(a) Vitamin A (b) Vitamin D
(c) Vitamin K (d) None

14. Coulomb is the scientific unit to measure:
(a) Velocity (b) Temperature
(c) Mass (d) None

15. Equator passes through one of these countries:
(a) Saudi Arabia (b) Italy
(c) Japan (d) None

16. Anti Diuretic hormone is secreted by one of the following glands:
(a) Pituitary (b) Pancreas
(c) Thyroid (d) None

17. Basha Dam is to be constructed on:
(a) River Sutlaj (b) River Jhelum
(c) River Chenab (d) None

18. UV light falls in the category of:
(a) Ionizing Radiations (b) Non-Ionizing Radiation
(c) Visible light (d) None

19. The earth's ....is divided into 15 major plates of various sizes:
(a) Membrane (b) Stratosphere
(c) Lithosphere (d) None

20. One of these scientists formulated basic laws of Geometry:
(a) Pythagorus (b) Archimedes
(c) Aristotle (d) None

21. Phosphorus is an essential component of one of the following biological molecules:
(a) Amino acids (b) Nucleic acids
(c) Carbohydrates (d) None

22. He was the first scientist to prove that plants move around the sun:
(a) Archimedes (b) Galileo Galilei
(c) John Kepler (d) None

23. Atom is made up of .... different kinds of subatomic particles:
(a) Three (b) Two
(c) Four (a) None

24. Uranium is best used as nuclear fuel in one of the following forms:
(a) U 235 (b) U 237
(c) U 238 (d) None

25. The alpha particles are compact clusters of:

(a) Electron and Proton (b) Two Protons and two Neutrons
(c) Three protons and three Neutrons(d) None

26. The Beta particles are fast moving
(a) Protons (b) Electrons
(c) Neutrons (d) None

27. One of the following countries produces maximum energy from atomic reactors:
(a) France (b) USA
(c) UK (d) None

28. The unit to measure the quantity of Ozone in atmosphere is
(a) Dobson (b) Dalton
(c) Coloumb (d) None

29. The severity of 2005 earthquake in Pakistan on Richter scale was
(a) 6.9 (b) 7.6
(c) 7.1 (d) None

30. Geiger-Muller counter is used to detect:
(a) Protons (b) Neutrons
(c) Photons (d) None

31. Vacuum tubes have been replaced by;
(a) Conductors (b) Diodes
(c) Transistors

32. Dacron is
(a) Polyethylene (b) Epoxy
(c) Polyamide (d) None

33. It is a secondary plant nutrient:
(a) Nitrogen (b) Phosphorus
(c) Sulphur (d) None

34. An area of microbiology that is concerned with the occurrence of disease in human population is
(a) Immunology (b) Paracitology
(c) Epidemiology (d) None

35. The number of electrons of a neutral atom is automatically known if one knows the:
(a) Atomic number (b) Atomic weight
(c) Number of orbitals (d) None

36. Which of the following is not an enzyme?
(a) Chemotrypsin (b) Secretin
(c) Pepsin (d) none

37. It is impossible for a type of O+ baby to have a type of............. mother:
(a) AB– (b) O–
(c) O+ (d) None

38. Serum if blood plasma minus its:

(a) Calcium ions (b) Clotting proteins
(c) Globulins (d) None

39. The autonomic nervous system innervates all of these except:
(a) Cardiac muscles (b) Skeletal muscles
(c) Smooth muscles (d) None

40. The damage to the .... nerve could result in the defect of the eye movement:
(a) Optic (b) Trigeminal
(c) Abducens (d) None

41. Which of these is not a region of the spinal cord?
(a) Thoracic (b) Pelvic
(c) Lumbar (d) None

42. The shape of the external ear is due to:
(a) Elastic cartilage (b) Fibrocartilage
(c) Articular cartilage (d) None

43. The external surface of the stomach is covered by
(a) Mucosa (b) Serosa
(c) Parietal peritoneum (d) None

44. Which of the following is not a human organ system?
(a) Integumentary (b) Muscular
(c) Epithelical

45. Which of the following does not vary predictably with the depth of the aquatic environment?
(a) Salinity (b) Temperature
(c) Penetration by sunlight (d) None

46. The quantity of available nutrients .... from the lower levels of the energy pyramids to the higher ones.
(a) Increases (b) Decreases
(c) Remains stable (d) None

47. Which of the following is not a major sub division of the biosphere?
(a) Hydrosphere (b) Stratosphere
(c) Lithosphere (d) None

48. Vaccination is synonymous with .... immunity.
(a) Natural active (b) Artificial passive
(c) Artificial active (d) None

49. When a patient's immune system becomes reactive to a drug, this is an example of:
(a) Super infection (b) Drug resistance
(c) Allergy (d) None

50. What is the smallest unit of heredity?
(a) Chromosomes (b) Gene
(c) Nucleotides (d) none

ANSWERS

1.	(a)	2.	(b)	3.	(a)	4.	(d)	5.	(c)	6.	(a)
7.	(a)	8.	(a)	9.	(d)	10.	(a)	11	(b)	12.	(c)
13.	(d)	14	(d)	15.	(d)	16.	(a)	17.	(d)	18.	(b)
19.	(c)	20.	(b)	21.	(b)	22.	(c)	23.	(a)	24.	(a)
25.	(b)	26.	(b)	27.	(a)	28.	(a)	29.	(b)	30.	(c)
31.	(c)	32.	(a)	33.	(c)	34.	(c)	35.	(a)	36.	(b)
37.	(a)	38.	(b)	39.	(b)	40.	(d)	41.	(b)	42.	(a)
43.	(b)	44.	(c)	45.	(a)	46.	(b)	47.	(b)	48.	(c)
49.	(c)	50	(b)								

PART - II

Attempt only FIVE Questions

Q.2. **(a)** "The flood disaster in Pakistan is caused by the follies of humans". Comment (5)

(b) State the message of "The Earth Hour Movement". (5)

Q.3. **(a)** Porifera is an ancient group of animals from Cambrian period. What is the cause of their survival/success? (5)

(b) How heavy water differs from ordinary water and what is its use in Atomic (5)

Q.4. What part do antibodies play in allergic reaction? How vaccination can be helpful in its control/prevention? (10)

Q.5. **(a)** Differentiate between Renewable and Non-renewable sources of energy. Give examples of each one of them. (5)

(b) Why Nuclear Energy is being preferred in developed countries and why are we lagging behind in this important source of energy? (5)

Q.6. **(a)** What is Nanotechnology and what are its use? (5)

(b) Briefly explain the differences between Chemotherapy and Radiotherapy. (5)

Q.7. Write Comprehensive note on:

(a) LASER and their use (5)

(b) OPTIC FIBRES and their importance in modern telecom system. (5)

Q.8. Write all that you know about Pesticides. How are they classified by agronomists? (10)

Q.9. Write note on:

(a) Biotechnology (5)

(b) Global Warming (5)

EVERYDAY SCIENCE 2014

GENERAL KNOWLEDGE PAPER-I
(SOLVED MCQS)

PART-I

Q. 1. Select the best option and fill in the appropriate Box on the answer sheet: (50 Marks)

1. The echo of Big Bang can be heard in the form of:
(a) Cosmic rays
(b) Gamma rays
(c) Microwave radio signals
(d) Infrared radiations

2. Omar Khyyam was a:
(a) Poet
(b) Mathematician
(c) Astronomer
(d) All of these

3. Who was the early dentist and also inventor of many surgical instruments?
(a) Avicenna
(b) Al-Zahrawi
(c) Ibn-ul-Haithem
(d) Al-Jahiz

4. Who was the first Muslim mathematician who used "Zero"?
(a) Ibne Baitar
(b) Ibn Rushd
(c) Ibn Al Haitham
(d) Al Khwarizmi

5. Why some nebulae shine?
(a) Because they emit light
(b) Due to burning process
(c) Because they contain bright stars
(d) Because they reflect light

6. A shooting star is
(a) Sun
(b) A comet
(c) A meteor
(d) An asteroid

7. A 'clinical death' takes place when:
(a) There is no pulse
(b) There is no heart beat
(c) Pupils are fixed and dilated and there is no reaction to light
(d) All of above

8. What is Hubble Classification?
(a) Classification of stars
(b) Classification of planets
(c) Classification of galaxies
(d) Classification of earth's zones

9. Sun rises in the east and sets in the west due to the:
(a) Shape of earth
(b) Rotation of earth around the sun
(c) Rotation of earth on its axis
(d) Movement of the sun

10. What are cyclones?
(a) Sudden heavy floods (b) No rain for a long period
(c) Heavy showers (d) Violent wind and rain

11. From ecological point of view human beings are taken as:
(a) Decomposers (b) Consumers
(c) Producers (d) All of these

12. The major cause of land pollution is:
(a) Pesticides (b) Chemical fertilizers
(c) Insecticides (d) All of these

13. The sharp-bitter taste of unripe fruits is due to high concentration of:
(a) Phenolic compounds (b) Volatile çompounds
(c) Organic acids (d) Starch

14. The use of antibiotic is a very effective way of killing disease causing bacteria. Sometime people don't finish all of their pills, this can result in:
(a) Some bacteria left unkilled
(b) Production of more bacteria
(c) Bacteria becoming sensitive to antibiotics
(d) Bacteria becoming resistant to antibiotics

15. Flesh eaters are called:
(a) Omnivores (b) Carnivores
(c) Herbivores (d) Scavengers

16. Chromosomes are made up of:
(a) DNA only (b) DNA & RNA
(c) Proteins only (d) DNA, RNA & Proteins

17. Plants can be made disease resistant by:
(a) Heat Treatment (b) Hormone treatment
(c) Colchicine treatment (d) Breeding with their wild relatives

18. Important ingredient used in vicks vapor rub is obtained from the plant:
(a) Cinnamomum camphora (b) Cinnamomum zelamicum
(c) Curaima longa (d) All of these

19. Which of the following is both endocrine and exocrine gland:
(a) Thyroid (b) Pancreas
(c) Parathyroid (d) All of these

20. The process by which small amount of impurities are added into a semiconductor is called:
(a) Addition (b) Conduction
(c) Doping (d) Insulating

21. Which of the following is a semiconductor?
(a) Mercury (b) Magnesium
(c) Silver (d) None of these

22. Silver fish belongs to:
    (a) Fish (b) Insect
    (c) Reptile (d) Amphibian

23. Satiety is the condition in which patient lacks desire to:
    (a) Drink (b) Eat
    (c) Sleep (d) Talk

24. Function of iron in our body is:
    (a) Provide strength (b) Oxygen transport
    (c) Help in hydrolysis (d) Breakdown fats

25. The non-communicable disease is called:
    (a) Endemic (b) Acute
    (c) Chronic (d) Innate

26. Vitamins A,D,E and K are called:
    (a) Water soluble vitamins (b) Primary vitamins
    (c) Basic vitamins (d) Fat soluble vitamins

27. Which is not a function of HCL in stomach?
    (a) Softening fibrous food elements
    (b) Promoting formation of pepsin
    (c) Killing bacteria ingested with food and drink
    (d) Breakdown proteins into peptones

28. The sum of the kinetic energy and potential energy of an oscillating body is:
    (a) Maximum in the beginning
    (b) Constant at all points
    (c) Maximum at midway of the path
    (d) Minimum in the beginning

29. Which term in psychology is generally used to refer to emotional disorders such as anxiety, depression and phobia?
    (a) Psyches (b) hypnosis
    (c) Neurosis (d) Mental illness

30. All Alkali metals react with water to form:
    (a) Oxides (b) Peroxides
    (c) Hydroxides (d) Hyper oxides

31. LASER is an acronym for:
    (a) Light amplification by standard emission of light
    (b) Light absorption stimulated entrance of radiation
    (c) Light amplification by stimulated emission of radiation
    (d) Light absorption by standard emission of radiation

32. If carbon dioxide is passed through lime water for a long time, the cloudy white colour (initially formed) disappears because of the formation of:
    (a) Calcium bicarbonate (b) Calcium hydroxide

(c) Calcium carbonate (d) Calcium sulphate

33. Permanent hardness of water is due to the presence of:
(a) Calcium bicarbonate (b) Magnesium bicarbonate
(c) Calcium sulphate (d) Sodium bicarbonate

34. Articles made of copper and bronze slowly tarnish in air and turn green, the green colour is due to the formation of:
(a) Copper oxide (b) Copper sulphide
(c) Copper oxalate (d) All of these

35. Bleaching powder losses its power on keeping for a long time because
(a) It changes into calcium hypochlorite
(b) It changes into calcium chloride and calcium hydroxide
(c) It absorbs moisture
(d) It changes into calcium chloride and calcium chlorate

36. When the quantity of charge on each of the two bodies is doubled, the force between them becomes
(a) One-fourth (b) One-half
(c) Twice (d) Four times

37. Light year is related to:
(a) Time (b) Distance
(c) Energy (d) Speed

38. The word ceramic means:
(a) Hard material (b) Soft material
(c) Dry material (d) Burnt material

39. The operation of solar cell is based on
(a) Laser technology (b) Photoconduction
(c) Thermal emission (d) Tyndall effect

40. The minimum number of bits required to store hexadecimal number AF is
(a) 2 (b) 4
(c) 8 (d) 16

41. Which of the following minerals is most resistant to chemical weathering?
(a) Olivine (b) Quartz
(c) Hornblende (d) Potassium feldspar

42. An igneous rock contains a radioactive isotope that has a half life of 10 million years. Careful analysis shows that only one quarter of the original concentration of the parent isotope is left. How old is this igneous rock?
(a) 10 Million years (b) 20 Million years
(c) 30 Million years (d) 40 Million years

43. The discipline which deals with the understanding and treatment of mental health is called:
(a) Applied psychology (b) Clinical psychology
(c) Psychoanalysis (d) Psychiatry

44. Overcooking of food should be avoided because overcooking:

(a) Makes the food difficult to digest
(b) Makes the food toxic
(c) Increase the nutritive value of food
(d) Reduces the nutritive value of food

45. Optical fibre operates on the principle of:

(a) Tyndal effect
(b) Photoelectric effect
(c) Laser technology
(d) Total internal reflection

46. The sensation of the skin is perceived by:

(a) Epidermis
(b) The dermis
(c) Endodermis
(d) None of these

47. The loudness of sound depends on its

(a) Wavelength
(b) Frequency
(c) Amplitude
(d) All of these

48. A person standing in front of a mirror finds his image smaller than him and erect. This implies that the mirror is:

(a) Plane
(b) Concave
(c) Convex
(d) Not of good quality

49. The densities of three liquids are D, 2D, 3(D). What will be the density of the resulting mixture if equal volumes of the three liquids are mixed?

(a) 1.5D
(b) 2D
(c) 3D
(d) 6D

50. Which of the following is a conventional designation of pre-released software?

(a) Raw
(b) Alpha
(c) Omega
(d) Beta

ANSWERS

1.	(c)	2.	(d)	3.	(b)	4.	(d)	5.	(d)	6.	(c)
7.	(b)	8.	(c)	9.	(c)	10.	(d)	11	(b)	12.	(d)
13.	(c)	14	(d)	15.	(b)	16.	(d)	17.	(d)	18.	(a)
19.	(b)	20.	(c)	21.	(d)	22.	(b)	23.	(b)	24.	(b)
25.	(d)	26.	(d)	27.	(a)	28.	(b)	29.	(c)	30.	(c)
31.	(c)	32.	(a)	33.	(c)	34.	(a)	35.	(c)	36.	(d)
37.	(b)	38.	(a)	39.	(b)	40.	(d)	41.	(b)	42.	(b)
43.	(b)	44.	(d)	45.	(d)	46.	(a)	47.	(c)	48.	(c)
49.	(b)	50	(d)								

PART-II

Q. 2. **Discuss the contribution of Muslim scientists in the development of Astronomy, Algebra and Trigonometry.** **(10)**

Q. 3. **Give brief answers to the following questions: (2 each)** **(10**

(a) Why do we bring our hands close to our mouth while shouting across to someone far away? (10)

(b) Why do we lean forward while climbing a hill?

(c) Why does a swimming pool appear less deep than it actually is?

(d) Why cannot petrol fire be extinguished by water?

(e) Why do Australians celebrate their Christmas during summer?

Q. 4. **Differentiate between (2 each)** **(10)**

(a) Hypoglycemia and Hyperglycemia.

(b) Renewable and Non-renewable energy resources.

(c) Lava and Magma (d) Mist and Fog (e) Lunar Eclipse and Solar Eclipse

Q. 5. **Briefly explain the working principle of the following: (5 each)** **(10)**

(a) Radar (b) Microwave Oven

Q. 6. **Give brief explanations for following phenomena: (2 each)** **(10)**

(a) While watching a cricket match we see the ball struck a moment before we hear the sound of the bat hitting the ball.

(b) A ship though made largely of steel, which is heavier than water, floats in water.

(c) The colour of the same clock when seen in electric light appears different from the colour when seen in day light.

(d) Glass when heated cracks while metal does not.

(e) Although each eye perceives a separate image, we do not see everything double.

Q. 7. **Write short NOTES on the following (5 each):**

(a) Environmental effects of Fertilizer use.

(b) Global Warming

Q. 8. **Differentiate between: (2 each)** **(10)**

(a) Smog and Smoke (b) Radiotherapy and Chemotherapy

(c) Diastolic and Systolic blood pressure

(d) Infection and Allergy (e) Conductors and Insulators

Q. 9. **Briefly explain the function of following in human body: (2½ each)** **(10)**

(a) Kidneys (b) Lymphatic system

(c) Thyroid gland (d) Pituitary gland

Did You know

You can unlock the sleeping potential of millions of years of evolution in your mind by deeper concentration.
We are all prisoners of time.
Our solar system contains about 50 satellites.
Extraterrestrial intelligence is a probable form of matter.
Halley's Comet will return in the year 2062.
The Hubble Space Telescope can look into the past.
Global Warming, Greenhouse Effect and Ozone hole are the Burning issues of the present day.
Electricity produced by Nuclear fusion would be too cheap to meter.
The crust of the earth is in dynamic state.
About 60 trillion cells make human body.
Gender of a person is determined by the 23rd chromosome pair.
Hepatitis B is more infectious than AIDS.
Levitating trains will run faster than Bullet Trains.
Nuclear waste continues to remain a constant threat for the mankind.
Ceramics are used for making superconductors.
DNA and RNA are molecules of life.
Volcanoes act as windows into the Earth's interior.
Plastics are so versatile materials that you can make a garbage bag or an army tank with them.
Good supply of vitamins can prevent cancer.
Computer virus was invented by Pakistani brothers.
DDT pesticide has been banned because of its residual effects.
Petrochemicals are used for making cosmetics.
Malaria is still maximum man hours eating disease.
LASER is coherent, concentrated and single frequency of light.
More than 2 million living species have been characterized.
Virus behaves like a terrorist in the human body.
Reservoirs of fossil fuels will last for only fifty more years.
You can harness your extrasensory perceptions by deep thought processing.

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